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CONSTRUCTION METHODS AND RECORDS ON A MISSISSIPPI CONCRETE JOB

A New Dual-Drum 34-E Paver and Ingenious Details in Grading, Joint Setting and Concrete Handling Help Make a Successful Contract

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Part I

MISSISSIPPI'S $42,000,000 "Sign of Progress" highway program has developed many points of interest for both engineers and contractors. On the project here described several new detail methods have been introduced by the contractor, but decidedly the most striking feature is the 34-E dual-drum mixer, which has just been produced by the Koehring Company and is here being used for the first time.

Hardaway Contracting Company, of Columbus, Georgia, was low bidder and received the contract for paving 15.52 miles on U.S. Route 11, just north of Laurel, Mississippi. This project was only recently graded, and particular attention was given to the placing of selected subgrade material. Some of the natural soils showed a volume change as high as 51 percent F.M.E. The thickness of the selected material placed on top of these bad soils depended on the

Fig. 1. The Koehring 34-E Dual-Drum Paver at Work Near Sandersville, Miss.

Fig. 2. Filling a Bag with Bulk Cement from Blaw-Knox Tank. Note 2 men standing on truck holding bag—also the scale operator and State's inspector above.

percent volume change, as determined by laboratory tests on field samples. However, the entire job was topped with a minimum of 12 in. selected material.

Slab and Joint Characteristics

Paving concrete was designed on a 1.45 cement factor, using 5.7 gallons of water per bag of cement. The paving slab—typical section of the Mississippi Highway Department—is 9-6-9 by 20 ft. wide. The 9-in. edge thickness tapers to 6 in. three feet from the form line on each side, the middle 14 ft. being of uniform 6 in. thickness. The slab carries wire mesh re-inforcing 2 in. down from the finished surface of the concrete, a longitudinal joint down the center line, an expansion joint every 90 ft., with transverse contraction joints at 30-ft. intervals between expansion joints.

The contractor, under Mississippi Specifications, may choose from several designated types of transverse and longitudinal joints. On this particular job a steel center strip for the longtitudinal joint, and premoulded asphalt for the transverse expansion joints were chosen. Load transfer at the expansion and contraction joints, is effected by dowel assemblies placed on the subgrade as units. There are several types of dowel assemblies, acceptable to the Mississippi Highway Department, from which the contractor may choose.

Material Handling and Storage

All material was shipped to the job by rail. The batching plant was located at Sandersville, 6.59 miles from the South end of the project and 8.93 miles from the North end. There was no dead haul from the batching plant to the project, as the highway at this point was parallel and adjacent to the right-of-way of the Southern Railway.

A Koehring Crane (one yard bucket) was used to unload sand and gravel from the cars into the Butler bins, which were set just far enough away from the track to leave a runway for the crane between cars and bins. Ordinarily not a very large stock-pile of gravel was kept on the ground. The contractor got two switches each day from the railroad, one around 7:00 A.M. and the other about 1:00 P.M. In this way, by properly "spotting" the cars, he could unload the gravel directly into the bins.

Sand Handling System.—The sand, however, presented another problem. Mississippi's Specifications require stockpiling of sand for 24 hours before using, in order to keep the moisture content of the sand as nearly uniform as possible, and at this point, the contractor first felt the effect of the big paver. In order to handle the volume of sand needed with the same crane and bins that had been used with the 27-E paver, and at the same time meet the stockpiling requirements, he found it necessary to re-handle some of the sand at night.

After a stock-pile was once built up for a day's run, the bins were loaded from that pile. In spotting his material on the switch track, the contractor had one car of sand placed between every two cars of gravel. When he came to the car of sand, it was unloaded at the end of the sand pile furtherest away from the bins. This he continued throughout the day, while he filled his bins from the old stock-pile which was nearest the bins. At the end of the day's run, the sand unloaded from the cars that day, was transferred closer to the bins for use the next day, and the same procedure repeated each succeeding day. At all times two men were kept in the cars to spot the bucket for the crane operator and to clean out the cars, thus speeding up the unloading as much as possible.

Batch Transportation.—The contractor used a fleet of Ford trucks to transport the materials to the paver. Each of these hauled two 8-bag batches, the truck body being divided in the middle by a hinged partition. These trucks in coming under the bins, on alternate trips, would head in on one trip and back in on the next. In this manner the gravel was placed on alternate sides of the partition, thus causing the body to "clean out" better when dumping at the paver.

Cement Handling.—The contractor elected to use bulk cement on this job, and transported it to the paver in large canvas bags each holding a complete 8-bag batch of cement. These bags were fastened to the front of the truck body and to the center gate. As the trucks came into the plant, while the driver was fastening the center gate and the tail gate, there was one man whose sole

duty was to fold these bags over the front of the truck and over the center gate. This placed the bag entirely out of the way of the aggregates as they were dumped into the truck. When the truck had been loaded with both batches of sand and gravel, it was driven under the cement bins, where one man on each side of the truck, got hold of the cement bag and held it up to a chute under the weighing hopper (see Fig. 2). The operator on the scale above controlled both the weighing and the dumping of the cement. As the bag filled with cement, it rested directly on the aggregate. When the full batch was in the bag, the two men holding it would make two folds at the open end and lay it flat on the aggregates, in which position it was hauled to the paver.

A good test was had recently of how well the cement is protected in these bags. Five trucks were caught on the road in a hard rain before they could be dumped. They were parked on the grade all night, and the next morning when paving operations were resumed, on only one batch was there any evidence of the cement having been wet. On that one batch, the bag had not been completely closed when it was folded.

The contractor used a Blaw-Knox cement tank of 50-barrel capacity. Cement was shipped in box cars, boarded up across the cars each side of the doors. This left a complete opening in each car from door to door, giving the men more room to work in unloading. Four to six men worked in a car at one time, unloading the cement into a hopper at the car door. They handled the cement by means of slip pans mounted on two small wheels underneath and equipped with plow handles. The cement was conveyed from the hopper to the storage tank above by means of a bucket elevator where it was weighed out and dumped into the bags on the trucks.

When the truck reached the paver, as it backed into the skip, one man on each side rode the body up to shake the cement bag as the other materials were dumped. The bag would automatically open from the weight of the cement, when the truck body was raised, but some shaking was necessary to completely clean it out. So much for the batch-hauling. Other materials, such as, dowel bars, assemblies, center steel, expansion joint material, wire mesh, etc., were hauled to the road by a service truck. Center steel and ½ in. bars and pins used in conjunction with center steel were carried on a rack built onto the paver. Other steel and joint materials were spaced at required intervals along the shoulder and ahead of the paver.

Now for approaching the paver with other operations.

Grading and Form Setting

A 60 Caterpillar tractor pulling a Killefer ripper scarified the subgrade lightly, and then using a Caterpillar 66 road machine, pushed excess material to each side. Since especial attention was given to placing selected material on this grade, the paving grade was laid with the idea of making the subgrade excavation and shoulder material needed, balance as nearly as possible. Total subgrade excavation on this job was estimated to average 20 cu. yd. per station. On this job the work done by the tractor and road machine did not have to be very close, however, the operators on this equipment string-checked behind their work to leave the grade as nearly uniformly high as possible. It might be said that this operation was merely preparing the grade for other grading equipment to follow.

Fig. 3. Aggregate Truck at Bin.
Note cement bag folded over front of truck body.

Form Work.—After the grader came the Carr form-trencher (see Fig. 4). The operator of this machine set his own grade line and cut the trench. A form foreman and crew followed the form-trencher, and set a grade line for the top of the forms. While some of the men were "touching up" high and low places left by the trencher, the others placed the forms just inside the grade line and spaced them properly for setting in the trench. When the form grade was ready, forms were set and enough pins driven to hold them in place. Other pins were placed in the sockets, and two men following up completed the driving. This crew usually finished the setting in and nailing down of 1700 to 1900 road feet of forms in about 7 hours. (See Fig. 5 for different stages of setting forms.)

Fine Grading.—After these forms were in place another cut was made of the grade with the R-B Subgrade Machine. This was set to leave the grade ½ to ¾ in. high.

Fig. 4. Carr Form Trencher at Work.
Note forms on shoulder to left, ready to set in place as soon as form trench is properly graded.

In operation, this machine is set to the proper shape of the base of the slab. It scarifies the grade lightly, and by means of a series of blades and elevators, deposits the excess dirt over the forms. Heavy ramps over the subgrade machine permitted operation of batch trucks at any time so that there was no interruption in hauling to paver. These ramps are fastened to the four corners of the machine by means of cables, but the weight of a truck passing over it is not taken by the machine. Each runway of the ramp is mounted on 6 wheels which roll on the subgrade. These wheels, 16 in. in diameter and having a 8-in. tread, are placed 4 under front end of each runway where the loaded truck mounts the machine and 2 under the back end of each runway where the empty trucks mount the machine. The subgrade machine merely pulls the ramps along with it, and keeps them in place. (See Fig. 6.) This machine stays seven or eight hundred feet ahead of the paver at all times. It operates under its own power, but when cutting, the wheels do not afford sufficient traction to prevent slipping. Two cables, one on each side of the road, operate on a drum or winch on the machine, and are hooked to form pins about 200 ft. ahead of the machine. As these cables are wound onto the drum, the machine is really pulled forward on the forms. When the full length of the cables are wound onto the drum, they are unhooked from the pins, wound off the drum, and hooked over another set of pins ahead.

Immediately behind the subgrade machine followed a crew consisting of a foreman and 6 men for final lining and tamping the forms. They first checked the forms from the grade stakes, then, after all irregularities in line or grade were taken out, thoroughly tamped them. A three-wheel 5-ton roller was kept on the grade at all times between the subgrade machine and the paver, although it was very seldom needed. Grade was left high enough ahead of the subgrade machine for it always to have some cutting if possible, thus leaving a uniformly shaped grade.

The distance between the sub-grade machine and the paver afforded plenty of room to get ample compaction from the trucks. The nature of the material in the subgrade, caused it to compact much better under truck hauling than it did under the roller. Final shaping of the grade was done by a push-planer fastened to the paver between the skip and the paver track, and by another planer fastened to the other end of the paver. A scratch template, hooked onto this last planer, but riding on the forms free of the planer, showed up any high places left in the grade.

Joint Installation

Each time the paver moved forward, grade men cleaned out dirt from in front of the planers, and along the forms where it spilled around the ends of the planers. Two more men placed the steel center strip, gauging it from the form line with a steel gauge. These same two men, placed a 4-ft. ½ in. round deformed bar through the steel center strip at 5 ft. intervals. These bars were supported midway between the top and bottom of the slab by means of steel wire chairs driven into the subgrade.

Fig. 5. Forms in left foreground completely fastened down—center background, forms in place but pins not driven—right foreground, as they are distributed just ready to set in place when trench is properly graded.

The joint men placed the dowel assemblies for expansion or contraction joints, one or the other of these joints coming after every third piece of center steel.

Contraction Joints.—The dowel assembly, two 10-ft. sections for each contraction joint, consisted of eight ¾ in. round smooth dowel bars, each 2 ft. long and spaced 15 in. apart, starting 7½ in. from the form on either side. Location of these bars with reference to surface of the pavement was 3 in. below the finished surface for the full width of the road. All dowel bars were painted with red lead and given a heavy coating of grease. The framework for holding the bars, consisted of 2 pieces of ½-in. steel, 9 ft. 6 in. long, fitted to hold the ends of the bars at the desired location in the slab. These pieces came in rights and lefts, and each pair supported 8 dowel bars, completing the unit for half the width of the roadway. A wire loop over the end of each dowel bar held it in place transversely with the pavement, and a small bracket fitted over the ends of each bar to hold it in its longitudinal position. To hold the bars at the proper distance from the surface of the pavement, stirrup supports were welded to the ½-in. pieces. A portion of these stirrup supports was bent, so it could be driven into the ground until the stirrup rested on the sub-grade. Additional hook-pins were driven into the grade to hold the assembly in place. (See Fig. 7 for center steel and contraction joint assembly in place.)

Assemblies for contraction joints were made up at the

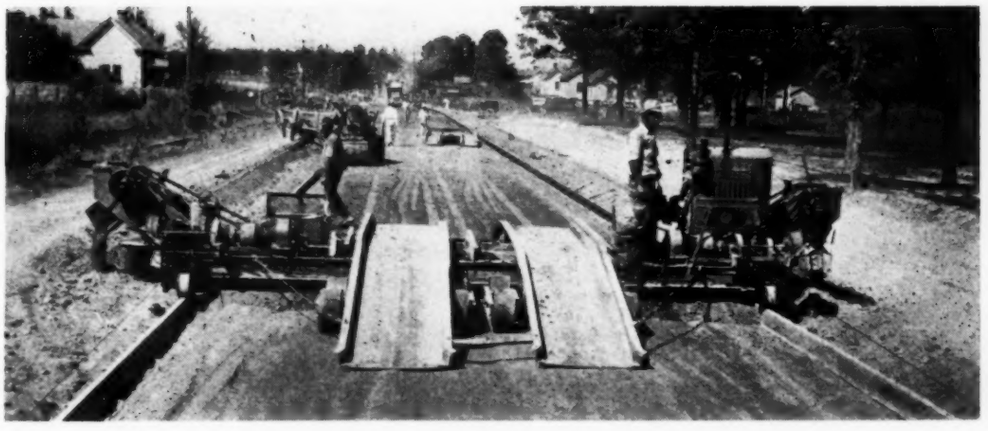

Fig. 6. R-B Sub-Grade Machine with Ramps for Material Trucks

Roller and truck turntable in background—paver in far distance.

material yard and hauled to the road as units. Two men were employed full time making these assemblies, painting dowel bars, and greasing bars for contraction joints only. The expansion joint assemblies were made up on the road.

How Expansion Joint Troubles Were Met.—Due to extremely hot weather, the premoulded asphalt type of expansion material would not stand up under much handling after it was assembled. Excessive handling, such as loading and unloading, spacing ahead of paver on shoulders, caused the holes left in the asphalt for the dowel bars to become much larger than they were supposed to be. This left ample opportunity for the concrete to flow around the bars into these enlarged openings, thus "locking" the joint and voiding all possibility of its functioning. To overcome this, assembling these joints on the road was tried, but without success until a special rack was devised. The service truck would distribute, every 90 ft. the material needed for a complete expansion joint. A rack, or trough, was devised with notches cut along the top edges of the sides, for the dowel bars to fit into. The bottom in this rack was just the proper distance below the dowel bars for the edge of the expansion material to rest on it when the bars were through the expansion material and resting in the notches. By letting the edge of the expansion material rest on the bottom of the rack, the strain was taken off the dowel holes, expansion material was held in a vertical position, and enlargement of dowel holes was prevented. The joint assemblies were left in this rack until they were taken out to place directly in their position in the subgrade, thereby resulting in only one handling of the joint after it was assembled. The supporting framework for these joints was similar in every respect to that used in the contraction joint, except that an expansion tube was welded to the ½-in. piece for one end of the dowel bar to fit into. These tubes were arranged to fit on alternate ends of the bars as assembled. One man was kept busy assemblying expansion joints.

Placing Concrete

When the dual-drum paver first came on the job, the big question was: Could the concrete be handled fast enough after it was placed on the ground to keep the paver going? The several considerations which brought this question up were, the handling of center steel, wire mats, dowel assemblies, joints and other finishing operations, together with a specified mixing time of one minute. So far, this question has been only partially answered. The only holdups have been for minor mechanical breakdowns, water shortage due to extreme dry weather conditions, or inadequacy of other equipment on the job to operate with the larger paver. However, it must also be said that the fastest mixing time that has been attempted is a batch every 42½ seconds, or one minute and 12 seconds mixing time for each batch.

The paver has an extra wide bucket, which enabled the operator to spread the concrete in a manner that left a minimum of handling with shovels. Concrete was dumped

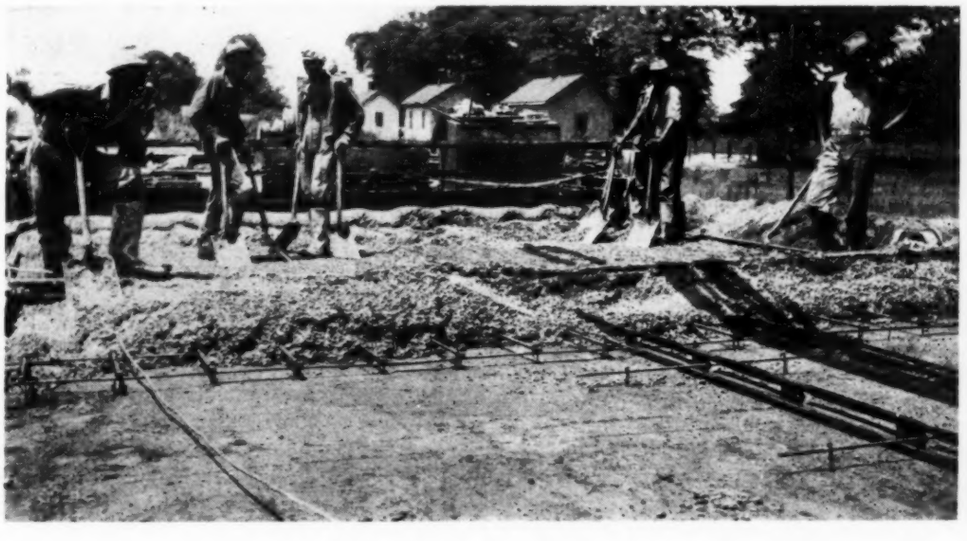

Fig. 7. Center Steel and Dowel Assembly for Contraction Joint in Place.

Note that strikeoff was stopped just as concrete came up against assembly. It will not be pulled over until enough concrete is placed around dowels to prevent displacement.

Fig. 8. Concrete "Cutters" handling Two Shovels Each.

Wire mesh has been placed and top layer of concrete is being cut down for finishing machine.

Note man on left holding wire mat ready to let fall in place as soon as strikeoff moves forward enough.

for the bottom layer and struck off to section 2 in. below finished grade. As the strike-off template was moved forward, three concrete cutters, or puddlers, stood on it and cut the concrete against the side forms and the center steel. Particular attention was given the joint assemblies as the concrete was struck off. Although this template would clear the joint assemblies for the contraction joints, if it was pulling a heavy load of concrete it would tend to push the assembly out of place as it passed over it. The strike-off template had to be stopped just as the concrete reached the joint assembly, and cutters shoveled concrete around the dowel bars before it could be pulled on over the assembly. In the case of expansion joints, the same was true, with the added problem of getting the strike-off over the premoulded expansion material and the metal joint holder. This was handled by means of a cam and lever arrangement on each end of the strike-off, which would raise the strike-off bar enough to clear the joints while one wheel on each end of the strike-off remained on the forms.

As soon as the concrete was cut down to proper grade for the wire mats one man on each side of the road would let one of the mats fall in place. These two men had no other duties than always to have a mat ready to place as soon as the concrete was ready. What small amount of moving or placing of the mat was necessary after it was dropped into place, was handled by the concrete cutters. As soon as the mats were placed, the operator spread the top course of concrete ahead of the Ord finishing machine. As the finisher moved forward the first time, it carried a rather heavy roll of concrete, and the concrete cutters had to keep this cut down to where the machine would not be overloaded or material would not be lost over the forms at each end of the screed.

Easier and More Efficient Hand Work.—The contractor had trained his cutters to handle two shovels at one time. The use of two shovels gives the men (see Fig. 8) a better balance, and by sliding the loaded shovels they get maximum results with minimum effort. There was no lifting or pushing concrete. The cutters merely shoved their shovels into the concrete to be moved, leaned back and pulled, dragging the concrete to where it was needed. However, cutting concrete is still a man's job. While the finishing machine was making the second trip over the concrete, the cutters had time to spade the concrete well against the side forms.

(Part 2 of this article, describing finishing and curing work, and giving a detailed account and records of the dual-drum paver will be given in October.)

Michigan County Road Construction Put on Federal Aid Plan

For the first time in the history of the State of Michigan, a program is being drafted for building local roads on a matched-fund basis. The $1,557,412 secondary road program, announced in August by the State Highway Department, provides that $1,136,912 be spent on county roads with the Federal government furnishing half the costs and the counties the other half.

In reality the program is an extension of the principle of Federal Aid construction to the local road system. Except for an interruption during the depression, state highway departments have been operating under this matched-fund plan for years.

Murray D. Van Wagoner, state highway commissioner, has applied this principle to a limited extent on previous local road construction. When Federal funds have been made available for local improvements, the commissioner has looked with favor upon projects where local authorities agreed to participate in the cost. This is the first instance, however, of an entire local road program drafted on the Federal Aid plan.

The new program will also provide higher standards of construction than heretofore practiced in some of the counties. The entire program will be under the supervision of the State Highway Department with state specifications and standards used.

In allocating these funds to the counties it is probable that a formula based upon population, area, and local road mileage, similar to that used in awarding the money to the states, will be used. Commissioner Van Wagoner expects actual construction on this program to get under way early in the fall.

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Georgia Highway Contractors' Association

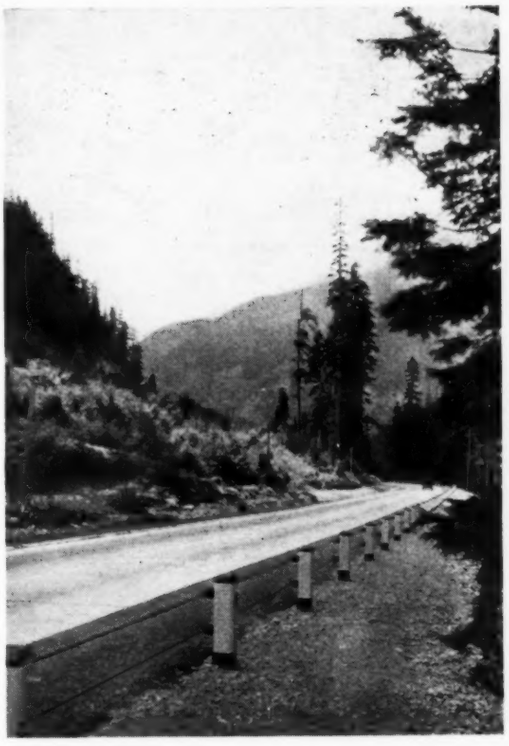
The Georgia Highway Contractors' Association, incorporated in the City of Atlanta on June 17 of this year, has a membership which includes about eighty-five percent of the licensed contractors operating in the State.

The Association's permanent offices are located at 612 Forsyth Bldg. Officers and directors are as follows: R. H. Wright, Jr., President; Alex MacDougald, Vice-President; M. G. Cox, Secretary; S. B. Slack, Treasurer; Paul L. Andrews, Executive Secretary; Henry Claussen, Director, Carl Espy, Sr., Director, Sam E. Finley, Director, D. B. Scott, Director, W. C. Shepherd, Director, Dave Wainer, Director, Marvin Woodall, Director, W. B. Young, Director.

MODERN INCLUSIVE HIGHWAY CODE ENACTED BY STATE OF WASHINGTON

New Codification Classifies Subjects Under Four Main Headings

By VICTOR J. BROWN
Publishing Director
Roads and Streets



Highway through Snoqualmie Pass, Washington, West of Summit.

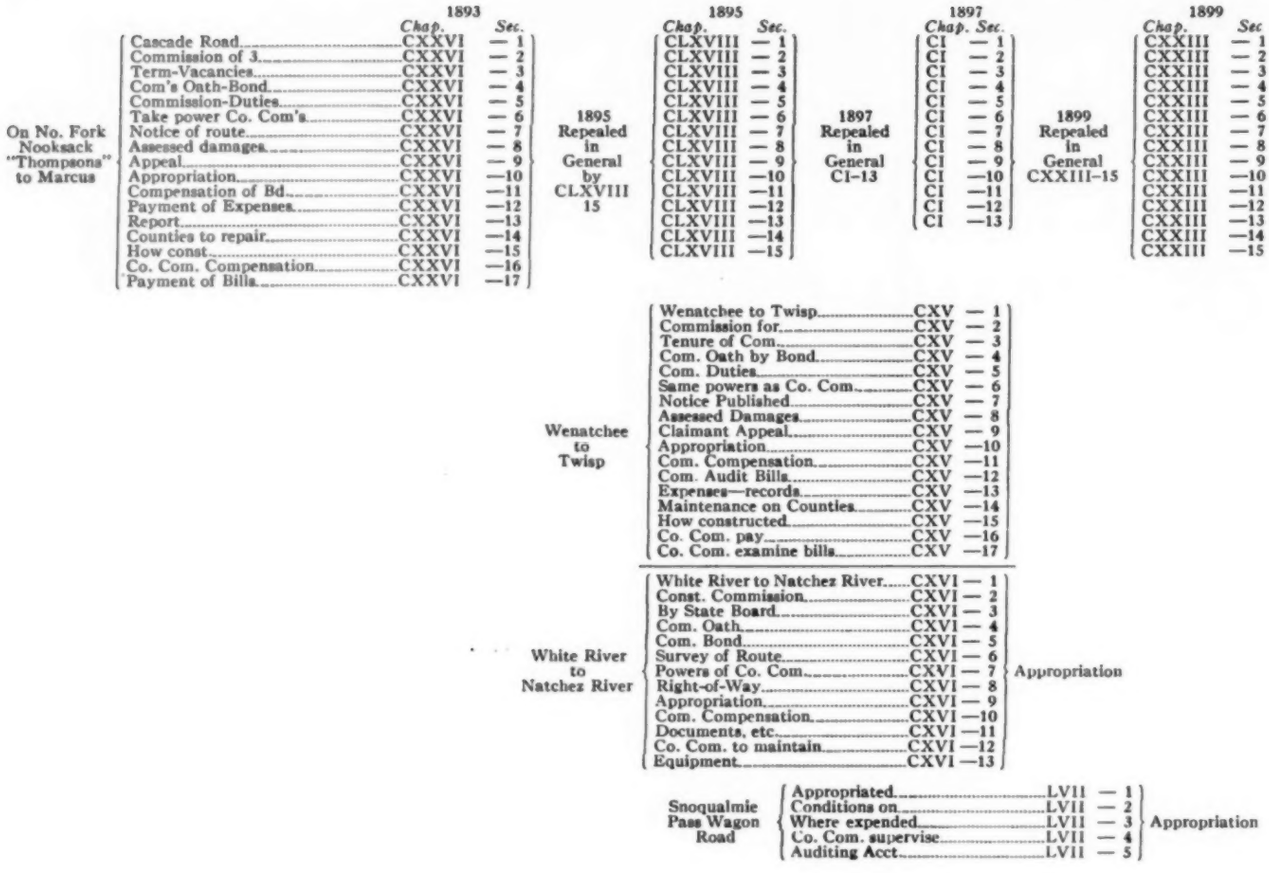
OVER a span of many years, extending from 1854 to the legislative period of this year, in the State of Washington, periodic legislation had created a great volume of highway laws in which duplication and conflict caused endless confusion. To simplify procedure and to eliminate obsolete and antiquated provisions of the then existing highway law, a new highway code was enacted. Modern, inclusive provisions replaced the horse and buggy provisions under which the Washington State Department of Highways had been operating. Good roads asociations and automobile clubs took an active part in educating the legislators and the people of Washington to the necessity for a new code. Director of Highways, Mr. L. V. Murrow, believes that Washington is the first state to codify its highway laws. Other states have collected the laws together in one volume but Washington enacted an entirely new and modern code.

In 1933 an interim highway law was passed. The state highway department for some previous time had advocated a codified highway law. The 1933 enactment instructed the governor and the director of highways to submit a code to the 1935 legislature. This was done but the code was rejected. However, attention was focused on the question to the extent that the 1935 legislature instructed the Director of Highways to submit a complete code of highway law to the 1937 sesion. The code was to embrace the subjects of highways and licensing and regulation of vehicles operating on the highways. As adopted it is divided into four broad classifications: (1) State Highways, (2) County Roads, City Streets, State Aid, (3) Motor Vehicles, Licenses, Registrations, Operators, and (4) Motor Vehicle Equipment, Operation, Inspection.

The purpose of any codification is to assemble all laws on one subject together and thus simplify reference procedure. In this case, coordination, condensation, and clarity were required to the degree that a new modern highway code was developed. Following is a discusion on the technique of the work as done by Mr. P. H. Winston, Attorney for the Department of Highways.

Historical Background

The historical background of the highway code is of interest, particularly, since in a great measure it establishes necessity for a codification. The first highway law in the State of Washington was enacted in 1854, many years before the territory was admitted to the Union as a state. Naturally the problem then was to provide merely a means of ingress and egress and neither population, traffic demands, nor property valuation dictated highway accommodations other than for limited transportation. Over a period of many years, until 1893, subsequent territorial and state legislatures provided for varying means of the highway administration. In the early stages of development, most of the administration of highways was upon the basis of local and individual demand and expense, and it was not until the latter part of the nineteenth century that county organization was given administrative function in the matter of highways. Early in the development of the county road administration, there was provision for toll roads which might be leased out to operating companies, and also, for roads constructed by private corporations where a toll might be charged for their use. It is quite evident, from the law of this early period, that subsequent legislatures had groped about at-



TYPICAL WORKSHEET SHOWING HOW ALL PREVIOUS ENACTMENTS WERE FOLLOWED THROUGH VARIOUS PHASES TO FINAL NEW CODE. EVERY CLAUSE IN THE EXISTING LAWS WAS RECORDED AND EITHER REWRITTEN OR REPEALED AS REQUIRED. THIS SHOWS THE FIRST HIGHWAYS ESTABLISHED

tempting to improve and modernize the mechanics of the county road administration.

The advent of a state highway system is found to have been first born in 1893, when the legislature appropriated funds for the use of a commission, in making a survey for the establishment of a cross-state highway, which was then and has since, been known as the Cascade Wagon Road. Again in 1895 funds were appropriated for the same purpose, and in this connection it is interesting to note, that subsequent experience has indicated the original route of the Cascade Wagon Road to be impracticable, exceedingly expensive of construction, and of insufficient service to the public. As a consequence, the Cascade Wagon Road has never been completed, but its successor, Primary State Highway Number 17, known as the Cascade Wagon Road, is found by re-enanctment in Section 17, of Chapter 190, Session laws of 1937.

In 1897 an additional appropriation was made on behalf of the Cascade Wagon Road, and further, a provision for a commission to lay out and establish a wagon road across the summit of the Cascade mountains, from White River on the west side, down American River on the east side, meeting a road on the Natchez River (which has since become known as the Naches River). This second established wagon road, which was a portion of what is now Primary State Highway No. 5, or the National Park Highway across Chinook Pass, designated in Section 5 of Chapter 190, Session laws of 1937. In 1899 we find an appropriation for use upon the Snoqualmie Pass Wagon Road, which road has since become Primary State Highway No. 2, or the Sunset Highway, described and designated in Section 1, Chapter 190, Session laws of 1937.

It will be seen that during the early period of county road administration, there was developing the realization that the transportation facilities were essentially a state problem. As a consequence, in 1905 there was established a state highway commissioner and a state highway board.

1901	1903	1905		1907 Chap.	Sec.	1909 Chap.	Sec.	
		Twisp to Sherman Cr. State Road No. 13 or Cascade Wagon Road		151	—4			5901
	(4) San Poil to Loomis	7— 7	State Road	72	—1	Lincoln Co. ex-	92—1	5901
			No. 4 App.	72	—2	tension to No. 4	92—2	5905
				151	—4	San Poil to Wilbur		
	Marble Mt. to Mill Creek	174—10	Marble Mt. to					
		174—11	Barron thence					
			Mill Cr. State					
			Road No. 11	151	—4			5901
						Hood Canal road		
						Hoodsport to		
						Duckabush State	61 —2	5902
						Road No. 14	61 —1	5903
						Garfield-Asotin		
						State Road	61 —1	5902
						No. 16	61 —3	5903
						Island-Skagit		
						State Road	61 —1	5902
						No. 17	61 —2	5902
						Alder to Kosmos		
						State Road	92 —1	
						No 18	92 —2	5905
			King Co.	72	—1			
			Natchez	72	—2			
			State Road	151	—4			5901
			No. 1					
	(1) Appropriation for	—7	Appropriation					
	(7) Appropriation	7— 7	Snoqualmie Pass			To Seattle	92 —1	5901
			Road State Road	151	—4	To Wenatchee	92 —2	5905
			No. 7			2 Extns. of No. 7		
	(2) Stevens and Ferry Counties —Newport to Orient	7— 7	Designated State Road No. 2	151	—4			5901
	(3) Chelan and Skagit Leavenworth to Darrington	7— 7	Chelan-Skagit Appropriation	72	—1			
				72	—2			5901
			State Road No. 3	151	—4			
	(5) Yakima and Lewis Naparine to North Yakima Cowlitz Pass State Road	7— 7		72	—1			
			State Road No. 5	72	—2			5901
			App.	151	—4			
	(6) Whatcom and Skagit-Skagit Line to Blanchard Slough	7— 7	State Road No. 6	151	—4			5901
	(8) Kickitat, Skamania and Clark Lyle V. Washougal	7— 7		72	—1			
			State Road No. 8	72	—2			5901
			App.	151	—4			
			State Road No. 9	72	—1			
	(9) Jefferson, Clallam, and Chehalis—Montesano to Port Angeles	7— 7	State Road No. 9	72	—2			5901
			App.	151	—4			
			State Road	72	—1			
	(10) Chelan and Okanogan-Wenatchee Riv. to Johnson Creek	7 —7	No. 10	72	—2			5901
			App.	151	—4			
				72	—1			
	Methow to Barron	174—12	State Road	72	—2			5901
			No. 12 App.	151	—4			
	State Roads	State Road Defined		151	—1			
		Survey first		151	—2			
		Following on State R		151	—3	Amended by 25-1		
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the commissioner to be appointed by the Governor, and the board to consist of a state auditor, state treasurer, and the highway commissioner. Subsequently from the early nineteen hundreds, the powers and duties of the highway administrative officer became amplified and defined as necessity required. The title of the administrative officer and the state agency having the authority over highways, was changed from the highway commissioner, to a supervisor of highways in a division of highways under the department of public works, and there was constituted a state highway committee. Subsequently these powers were transferred to a state highway engineer as an appointee of the Governor, and in 1929 the administrative code created the department of highways and the office of director of highways, the office and department which is preserved to the present day.

It may well be seen that by accretion over a period of years, the powers and duties of road building agencies had become involved to the point of confusion and a great body of law by legislative enactment and re-enactment had accumulated. In addition to this, following the advent of the motor vehicle, laws became necessary for the control of traffic, but there were yet on the statute books such a provision as the laws of 1879, contained in the Remington's Revised Statutes, Section 2718, providing that, "Any person or persons riding or driving faster than a walk over any bridge located on any county or state road, composed of one or more spans, upon conviction thereof shall be fined in any sum not to exceed ten dollars nor less than five dollars****", and the law contained in Section 6295 of Remington's Revised Statutes still then in force from 1869, provides that, "Whenever any person driving any vehicle shall meet on any public highway in

this state, whether owned or kept by a corporation or private person, the persons so meeting shall reasonably turn their vehicles to the right of the center of the road, so as to permit each vehicle to pass without interfering with or interrupting the other vehicle." This last section, together with a penalty clause was apparently the first and only vehicle operating provisions in force in the year 1869.

Since that time many enactments have been made in an effort to regulate motor vehicles, but the law lagged behind modern transportation conditions and requirements. Quite naturally from this accumulated body of enactments, re-enactments, and amendments, a question of what law is in force and which conflicting provisions were to be adhered to, became important.

In the face of all this, and in an effort to place highway construction and motor vehicle administration upon a basis consistent with modern demands the legislature required a complete codification.

Mechanics of Codification

It may be seen that the first problem of codification was to determine all laws in existence in the State of Washington, relating to the subject of highways. This meant that the department could not rely upon codes drawn by private concerns or upon any analysis of the preceding laws, but necessarily had to go through the laws from 1854 to and including 1935, page by page and search out every provision relating to highways. This was accomplished by recording each provision chronologically and in diagrammatic form. A sample worksheet of this procedure is shown herewith. The worksheet contains the record of the first legally adopted roads. In the progress of this work it was necesary to consider prior enactments to determine if they had been repealed either expressly or by implication, or whether they had been superseded. By this means all the laws in the State of Washington were brought down to the end of the year 1935. From the diagrammatic arrangement of the laws, repealing sections were written into the new code to effectively repeal all existing laws in the State of Washington, the former repeal of which were in doubt. Those provisions which could not be repealed without seriously affecting some existing function, or involved the function of another department, had to be set aside and permitted to exist, bearing in mind continually that they should not be inconsistent with or repealed by the new code.

After a little more than a year spent in searching the laws of this state, the department of Highways then called upon the experiences of all other states and looked to their legislative enactments for cousel in compiling a new code. When all possible subjects of codification were determined, they were arranged in logical order by subject and in the summer of 1934, the provisions of the proposed code were published and copies were delivered to the members of the legislature and to all interested corporations, persons and groups requesting constructive criticism and comment. After going over the code in its tentative form, with all interested groups which desired to be heard, the corrected code was again mimeographed and sent to those members elected to sit in the legislative chambers in the regular session of 1937. This was sent on November 15, 1936, again requesting any criticism or comment on these provisions. At the opening of the session in January 1937, the code was submitted in bill form, introduced both in the House and in the Senate, and consisted of four acts as follows:

The first act is known as "The Washington State Highway Act," which subsequently became Chapter 53 of the Session Laws of 1937; the second act is known as "The Washington State Aid Highway Act," which subsequently became Chapter 187, Session Laws of 1937; the third act known as "The Washington Highway License Act," which subsequently became Chapter 188, Session Laws of 1937; and the fourth act known as "The Washington Motor Vehicle Act," which subsequently became Chapter 189, Session Laws of 1937.

During the course of the legislature, it became apparent that there was a demand for adding milage to the primary state system, and while the primary state system was designated in the Washington State Highway Act, it was deleted by amendment, and subsequently was passed, becoming Chapter 190, Session laws of 1937. At the same time the demand for additional roads under state administration, and the necessity for state supervision of farm to market and feeder roads to take advantage of the state apportionment of federal funds allocated for that purpose, gave rise to Chapter 207, Session laws of 1937, which establishes a secondary state highway system of those roads reasonably classified as farm to market, feeder, post or secondary roads tributary to the primary state system.

Through all this period, from early days to the first of 1937, had run the matter of financing the highways of the state. In the inception highways were financed almost entirely through local improvement districts. Later a county tax levy and other means of property or personal levy supplied the funds. A short time after the establishment of the state highway commissioner, the motor vehicle fuel tax made its appearance. During all this period the trend had been away from the financing of roads by means of individual or property levy, and in the direction of financing by a tax upon the highway user. Adjustment of the tax structure has resulted in the very small proportion of highway revenues from property levying and the great bulk of these funds coming from a five cent tax per gallon on motor vehicle fuel. The money arising from this source is used for all road building agencies, being distributed to cities upon a per capita basis, to counties upon an established percentage of two and three-fourths cents per gallon, and the balance for the use of the State. Chapter 208, Session Laws of 1937, provides the basis for the distribution of motor vehicle gas tax and vehicle license fees. This part is carried in a separate chapter, since it contains distribution of funds, which is subject to change from year to year, and also contains appropriations which lapse at the end of each two-year period. This separation was deemed necessary, since the provisions of the code are designed to be basic and remain stable over a period of years, while the distribution of funds and appropriations, by their very nature, are subject to biennial re-enactment.

One additional fact is of interest, in that it was found necessary to retain in the state a supervision of city and county expenditure of state funds, and the Washington State Aid Highway Act provides for the supervision by

the department of highways of expenditures, plans and specifications, and the construction and maintenance work financed from state funds. This is accomplished by a system of reimbursement by which the city or county first performs the work and pays for it out of its own funds, and then receives allocation from the motor vehicle fund upon proper reimbursement vouchers approved by the director of highways.

In the inception, it was considered that the highway code should provide an adequate, co-ordinated, and comprehensive transportation system; that the law should provide mechanics by which this system would be administered by the proper road building agencies as efficiently and economically as possible; and that transportation on the highways should be impressed with the highest possible margin of safety. To this end the code was drawn repealing some 2500 sections of law, much of which was obsolete, and enacting some 400 sections, bringing the highway laws of the state down to April 1, 1937. An effort was made, in addition, to make the laws simple and concise in statement, reasonable in application, and capable of being applied, interpreted and enforced without being burdensome. Only experience will dictate whether or not this law will serve its purpose, and if that experience is favorable, the State of Washington will have come out of a confused past with a basic enactment designed consistent with reasonable foresight.

Continuation of this article will appear in the October issue. Features of the Code are discussed by Code headings.

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Nearly 16 Cents of Every Dollar of State Highway Taxes in 1936 Was Spent for Non-Highway Uses

NEARLY 16 cents out of every dollar of State taxes paid by highway users in 1936 was assigned to non-highway use according to statistics collected from state authorities by the Bureau of Public Roads of the U. S. Department of Agriculture. Collections from state gasoline taxes, motor vehicle registration fees and motor-carrier taxes amounted to over a billion dollars. Allocations to non-highway purposes amounted to $169,344,000, an increase of $22,202,000 over the previous year.

Other allocations were $583,616,000 for State highway purposes; $265,496,000 for local roads and streets; $37,942,000 for collection and administration; $1,597,000 for other highway purposes such as park and forest roads, etc.; and $8,346,000 was undistributed.

State taxes on highway users included registration fees and licenses amounting to $359,784,000, gasoline taxes of $691,420,000, and special taxes on motor carriers of $15,137,000. These taxes have been justified on the grounds that they are for the building and maintenance of good roads over which the vehicles must travel. Any other use of these funds, says the Bureau of Public Roads, detracts materially from the upkeep of the highways for which the motoring public is paying. In 1936, almost one-third as much was used for non-highway purposes as was used for the building and maintenance of State highways.

Of the State taxes on highway users employed for other than highway purposes, about $89,000,000 went to the general State, county and municipal funds; $36,500,000 was paid for relief of unemployment; $33,000,000 was given to education; and approximately 11,000,000 for miscellaneous purposes, such as airports, navigation, service of non-highway debts, irrigation, parks, and other purposes.

The amounts of motor vehicle revenues allocated by each state for state highway purposes, for local roads and streets, and for non-highway purposes, are given below:

State	For State Highway Purposes 1,000 Dollars	For Local Roads and Streets 1,000 Dollars	For Non-Highway Purposes 1,000 Dollars
Alabama	8,849	5,743	725
Arizona	3,619	1,149	7
Arkansas	10,887	656	77
California	38,048	18,058	5,427
Colorado	6,095	2,878	....
Connecticut	10,744	3,259	123
Delaware	2,389	502	....
Florida	11,352	5,909	7,802
Georgia	12,459	2,814	2,901
Idaho	4,110	1,812	....
Illinois	27,555	16,433	7,412
Indiana	11,403	12,067	3,356
Iowa	16,684	5,728	....
Kansas	9,784	3,600	....
Kentucky	14,503	602	799
Louisiana	11,795	....	3,487
Maine	7,893	850	....
Maryland	5,889	4,506	538
Massachusetts	12,329	4,434	6,126
Michigan	19,408	24,227	342
Minnesota	14,538	3,421	194
Mississippi	5,135	5,426	....
Missouri	19,547	....	66
Montana	4,386	1,458	....
Nebraska	6,249	4,805	2,238
Nevada	1,526	....	....
New Hampshire	5,139	547	....
New Jersey	17,308	11,215	13,275
New Mexico	3,990	180	480
New York	22,977	17,289	59,790
North Carolina	16,597	9,059	2,432
North Dakota	2,348	1,597	5
Ohio	24,114	31,448	11,470
Oklahoma	8,261	5,466	3,882
Oregon	10,463	1,600	238
Pennsylvania	56,622	8,740	12,607
Rhode Island	2,891	....	1,995
South Carolina	9,689	1,579	154
South Dakota	2,570	1,157	2,131
Tennessee	13,069	4,842	3,654
Texas	33,520	10,893	9,307
Utah	3,863	....	45
Vermont	2,956	1,280	....
Virginia	13,984	6,157	30
Washington	6,612	9,570	942
West Virginia	11,694	819	....
Wisconsin	15,431	8,784	4,355
Wyoming	2,342	555	....
District of Columbia	....	2,382	932
TOTAL	583,619	265,496	169,344

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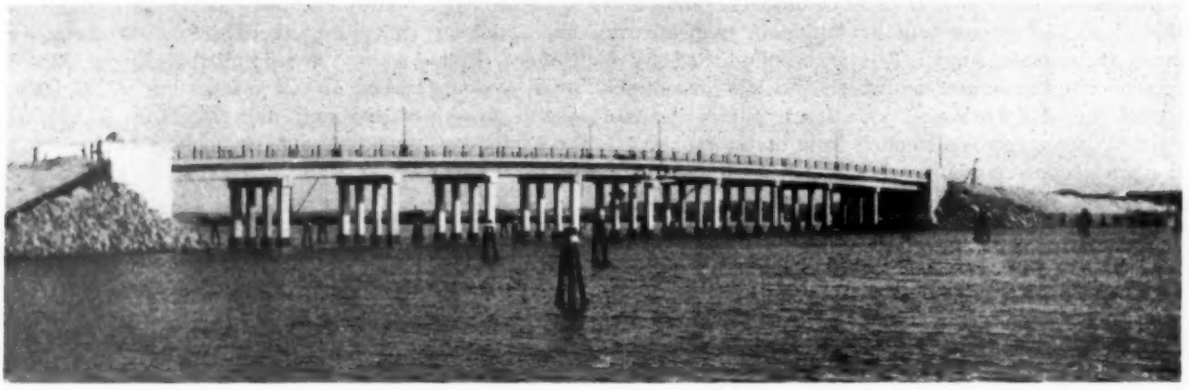
HIGHWAYS EXCEEDING 2-LANE WIDTHS—There are 7,432 miles of highways on state systems having more than two lanes, according to American Highways for July. This includes 4,655 miles of 3-lane highway; 2,576 miles of 4-lane; and 201 miles of 6-lane.



THE CONCRETE TRESTLE AT SAG HARBOR

Twenty-four-inch Square Piles 65 Feet Long Used in 390-Foot Long Island Structure

ANOTHER link in the proposed highway system which will encompass Peconic Bay in Long Island, New York, was completed in April, 1937. The construction of the 390-ft. concrete pile bridge at the old whaling port of Sag Harbor leaves the bridges to Shelter Island the only missing portions of the route which will make the recreational facilities on this island more accessible to the general public.

Shelter Island, which separates Peconic Bay and Gardiner's Bay at the eastern end of Long Island, lies between the towns of Sag Harbor and Greenport. The highway on the southern side of Long Island crosses a narrow estuary of Gardiner's Bay at Sag Harbor, to North Haven, where a ferry crosses to the southern side of Shelter Island. At Greenport a ferry connects the upper part of Shelter Island with the main highway that follows the northern shore of Long Island.

Two suspension bridges will soon replace the Shelter Island ferries and provide a direct thoroughfare across Shelter Island that will connect the two shore line highways. The old bridge at Sag Harbor was not considered a suitable link in this proposed development and a permanent structure was erected.

The New York State Department of Public Works found the pile trestle bridge to be the type best suited for this location, since test borings showed underlying strata of sand and gravel capable of carrying very heavy pile loads. Nine bents, each consisting of four 24-in. piles, divide the structure into ten 39-ft. spans. Concrete sheet piling prevents the sea water from undercutting the abutments which are also braced on the channel side with concrete batter piles.

Concrete girders are cast integrally with the deck, which carries a 24-in. roadway with a 5-ft. sidewalk on either side. The design is based on a standard H-20 loading, which is the equivalent of the load induced by a 20-ton truck preceded and followed by an indefinite number of 15-ton trucks. This required that the piles be designed for a working load of 72 tons each. The possibility of the presence of teredo navalis in these waters was not a factor in choosing concrete piles for this bridge, the selection being made solely on the basis of economy and general desirability of concrete for use in sea water.

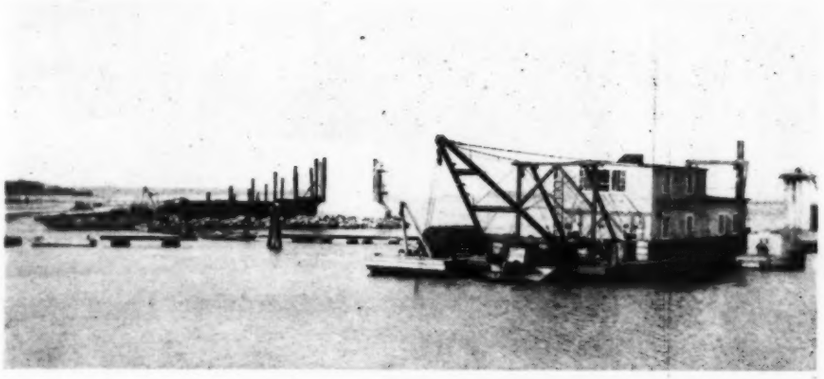
Two types of piles were used in the main bents of the bridge. The interior piles are 2 ft. square with 1-in. chamfered corners and have a 6-in. batter in the lower 2 ft. to produce a blunt point. Reinforcing steel consists of four 1¼-in. square bars at the corners and four 1-in. round bars placed at the quarter points. These bars, which extend 4 ft. 2 in. beyond the cap, are bound with ¼-in. hoops for the length of the piles with the exception of the lower 4 ft. and upper 3 ft., where 5/16-in. hoops were used. Hoop spacings varied from 3 to 12 in.

The piles used on the exterior of the bents are similar to those in the interior with the exception of their upper 24 ft., which were increased to 2 ft. 8 in. on the sides. The corner bars in the lower section of these piles extend 4 ft. into the enlarged portion while the intermediate bars run the full length.

Both types were designed for an estimated penetration of 40 ft., which brought their total length between 60 and 70 ft.

The batter piles used for the abutments are similar in design to the interior piles in the main bents, but are only 18 in. square and 48 ft. long, and are reinforced with 1⅛ in. square bars extending 3 ft. 9 in. beyond their tops.

Sheet piling used under the abutments are 28 ft. long, 2 ft. wide and 1 ft. 4 in. thick with tongue and groove joints running their full length. The six 1-in. square bars used to reinforce these piles are located and bound in the



Construction Well Started—Abutment at Left—Newly Driven Bent at Right.

same manner as the bars used in the other piles. The piles used at the corners of the abutments are 2 ft. x 1 ft. 8 in. and have tongue and groove joints on adjacent sides.

All the piles were precast at Sag Harbor, and an average production of 5 piles per day was maintained by the use of wooden gang forms. A 1:2½:3 mix with a water cement ratio of 6 gal, per bag was specified for the piles, which were vibrated internally by a gasoline driven vibrator and cured under wet burlap for five days on the casting platform and five additional days while in the storage yard. The size of these piles, some of which were 65 ft. long and weighed nearly 20 tons, necessitated care in handling and required the pick-up points to be determined in the design and marked on the piles for the driving crews. No difficulty was encountered in handling since a floating crane placed the piles on scows which were towed directly to the bridge site.

No leads were employed in driving the piles. A wooden pile guide bent was driven at the location of each permanent bent and a templet was framed to the tops of these to assist in holding and guiding the bearing piles.

The driving was done by a steam pile hammer mounted on a scow. A 10,000-lb. hammer with a 5,000-lb. ram striking a 17,500-ft.-lb. blow was used to drive the test piles. These were then loaded to 144 tons, or double the designed working load, by placing a water tank on top of them and filling it to a predetermined depth. Bearing piles were driven with a 13,185-lb. hammer which struck a 22,080-ft.-lb. blow with a 3,625-lb. ram. A laminated cushion of 1-in. dressed oak boards was placed between the hammer dolly and the pile cap to prevent injury to the pile heads. Most of the piles were jetted before driving as the sand and gravel subsoil was especially suitable for this operation.

Caps for the pile bents and the deck slabs were cast in place using the same mix as in the piles. The forms for the deck slabs were supported on I-beams resting on cross timbers placed at the bents. Corbels clamped to the piles supported these cross timbers and eliminated the necessity for shoring. This type of construction was possible since the piles were of uniform size and their friction surface effective for their full periphery. The dead weight of the forms, beams and slabs amounted to about 25 tons on each interior pile and about 42 on the exterior members of the bents.

A General View of Construction Operations.

Casting of the piles was started in March, 1936 while the construction of the bridge began in April and was completed in January, 1937. The Frank A. O'Hare Company of New York City was the contractor.

The importance of the Sag Harbor bridge to Shelter Island and the Long Island highway system will be materially increased when the suspension bridges which are to replace the Shelter Island ferries are constructed. The project which covers the erection of these structures has already been approved for a PWA loan and grant.

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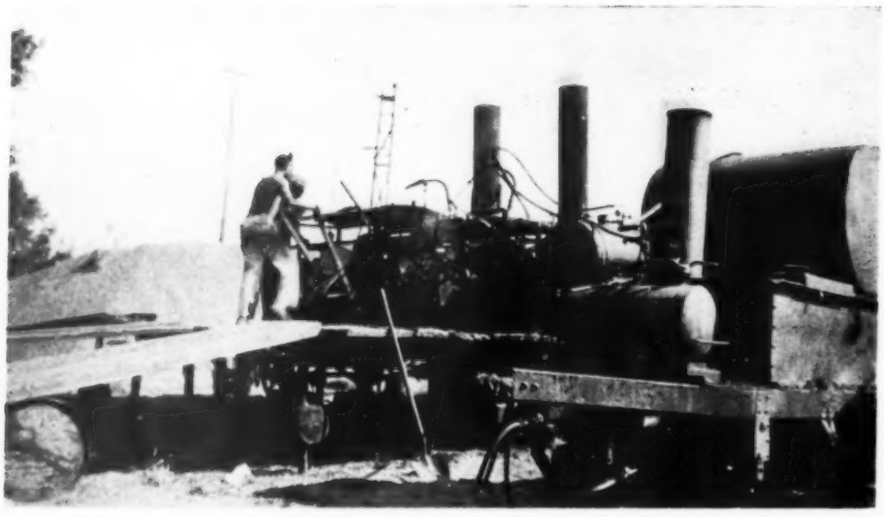
Z. E. Sevison Made Chief Engineer of North Dakota Highway Department

Z. E. Sevison, for many years Chief Engineer of the Wyoming State Highway Department, was appointed late in August as Chief Engineer of the North Dakota Highway Department, with instructions to undertake such measures of reorganization as he may find necessary to put the department on a thoroughly efficient footing.



View of Charging Side. This Machine Was Designed by the Oregon State Highway Commission.

HOT PATCH MAINTENANCE IN OREGON

SOONER or later, when road surfaces get rough, they must be smoothed. This can be accomplished in three ways:

1. Rebuild or resurface.
2. Patch with smooth patches.
3. Plane or shave the surface.

The first method is relatively expensive. The second method may be relatively expensive but is usually a low cost procedure. The third method is relatively low cost.

Oregon employs a patching method or system different from the other states. Whether the patch necessary is on portland cement concrete or on a bituminous type, the method is the same. It is based upon the employment of skilled personnel for acceptable results.

The low place in the surface is outlined with chalk by a man who gauges the size of the low area by eye, sometimes assisted by a straight-edge. The edges are painted with hot asphalt and the area cross streaked. A truck load of hot patching material is backed up and the mixture shoveled onto the low place. Rakers then spread the mixture which is evened up by a skilled raker. Fines are raked to the edges in order to make them feather-edge. Immediately following the rakers is a 6-ton tandem roller which rolls the inside feather-edge first. All patches in Oregon are rolled until the patch has set. The patch is then sealed with a light application of cut-back asphalt and covered with sand.

Preparing Patch Mixture—For preparation of the patching material a designed grading of aggregate is mixed in a double drum bituminous mixer designed by the Oregon State Highway Commission. Accompanying pictures show different views of this machine. Coarse and fine aggregates are analyzed in the laboratory for gradation and mixed by volume to obtain the designed density. Torches heat the mixture in the drums. While one drum is mixing and heating the mixture to 220 degrees in the case of cut back asphalt, and 350 degrees in the case of 50-60 penetration asphalt cement, the other drum is being charged. The torches blow from the charging end of the drums and can be rolled to one side during charging. Discharge gates at the opposite end of the drums pour the hot mixture into dump-bodied trucks.

One machine turns out from 120 to 220 tons per day of two 7 hour shifts. The output is governed by the amount

General View of Mixer from Discharge Side.

Spreading and Raking Patching Material.

of patching necessary. When rolled in place, the patch material costs approximately $6.50 per ton. The machine is built from state plans at a cost of $3,500 to $4,000. Oregon operates 7 of these outfits under the supervision of the maintenance department.

Manual of Regulations.—General instructions and specifications relative to the operation of portable pavement patching plants are contained in a manual prepared

Rolling Patches With a 6-ton Buffalo-Springfield Tandem Roller.

under the direction of Mr. R. H. Baldock, State Highway Engineer. This manual is quite comprehensive. It not only gives specifications for mixing patching materials but, also, general instructions regarding employment, the merit system, use of alcoholic liquors, traffic control, working time, care of equipment, reports, property control, and other letters of instruction pertaining to the operation of a patching gang.

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National Asphalt Conference at Memphis

The Board of Directors of the Asphalt Institute have decided to hold the 1937 National Asphalt Conference in Memphis during the week of Dec. 6th. This conference will serve as a clearing house for information on methods of road-building, soil stabilization, flood-control, harbor protection, airport surfacing and of building safety into and alongside of highways.

The Association of Asphalt Paving Technologists will meet at the same time as the National Asphalt Conference, probably in a three-day session devoted to complete discussions of technical problems relating to asphalt.

Triborough and Astoria Boulevard Bridges Receive American Institute of Steel Construction Awards for Beauty of Construction

Stainless steel plaques commemorating them as the most beautiful bridges of their class erected last year were affixed to the East River Crossing of the Triborough Bridge and the Astoria Boulevard Bridge over the Grand Central Parkway Extension on August 21. These bridges had been selected by a jury appointed by the American Institute of Steel Construction, as respectively the most beautiful monumental structure and the most beautiful small bridge erected in 1936. The plaques were presented by Mr. Clyde G. Conley, President of the Institute, and were accepted by Mr. Robert Moses, Chairman of the Triborough Bridge Authority and President of the Long Island State Park Commission.

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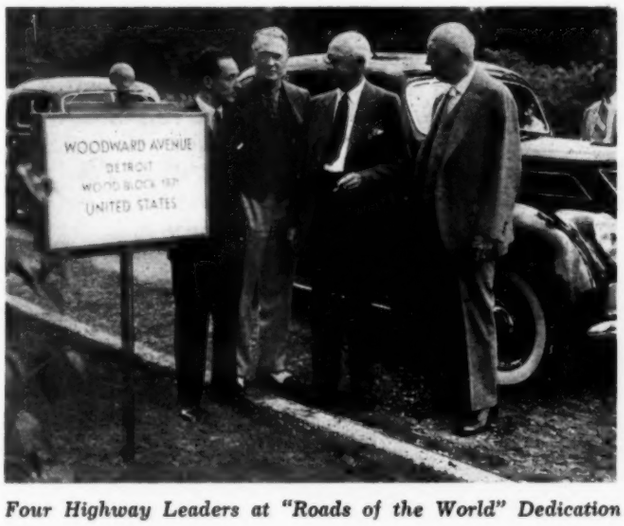
A Permanent Exhibit of Famous Roads

Consuls of foreign countries and good roads association representatives took part recently in dedication of the "Roads of the World," a half-mile roadway comprising reproductions of 18 world famous highways, newest feature at the Ford Rotunda, gateway to the Ford Rouge plant at Dearborn, Michigan. In the picture below, Edsel B. Ford, president, Ford Motor Company; Richard Harfst, general manager, Automobile Club of Michigan; Edward N. Hines, chairman of the Wayne County Road Commission, widely-known as the "father" of the good roads movements in the United States, and Charles L. Weeks, president, Automobile Club of Michigan are standing on the edge of the reproduced section of Woodward avenue, Detroit. For nearly a half century this thoroughfare has been a "laboratory" for the testing of various kinds of paving material. Parts of it have been paved with packed earth, wood blocks, brick, planks, cobblestones and asphalt concrete. A private company built an extension of this avenue from the Detroit corporation line to Pontiac in 1849. It was paved with planks and operated as a toll road.



Four Highway Leaders at "Roads of the World" Dedication

An Interesting Aggregate Plant Owned and Operated by Wyoming State Highway Department. The crushing and screening plant is a Diamond No. 836, producing from 350 to 400 tons of ⅛ in. to ⅝ in. material per 8-hour shift. It is driven by a Caterpillar D8800 diesel engine. Rock is delivered to the crusher and spoil is removed with two rotary scrapers pulled respectively by a Caterpillar RD6 and an RD4.

A New Road-Binding Material

From the Pacific Coast—birthplace of many a wood product and by-product—comes news of a road binding material having as its main ingredient the cement which holds wood fibers together in those forms which have proved so useful to man since he first learned to use his hands. The following account is from the August issue of The Elbee Tatler.

Raylig is red lignin liquor, developed by a Mr. Bernhard Weinicki, a by-product of the manufacture of rayon pulp, being introduced as a road binder for stabilization. Lignin is the natural cement that binds the fibres of wood together in the tree. Extracted from the hemlock trees of the Pacific Northwest, the ligin liquor is chemically processed, neutralized and concentrated, and is now being used for binding and stabilizing loose road materials at exceptionally low cost.

Lignin comes from the digester in the mill usually in a concentration of about 8 per cent solids. This solution, under the process now being used by the Rainier Pulp & Paper Co. to produce this binder, is concentrated to a 46 per cent solids solution. As this high concentration does not readily adapt itself to use in an ordinary pressure distributor, approximately equal parts of cold water are added to bring the solution down to about 26 per cent solids, at which point it is ready to apply on the road surface. It is shipped in tank cars of six to ten thousand gallons capacity, in trucks of varying capacity, in scows or in intercoastal liners. Efforts to produce it in powder form for easier transportation are being carried on.

No heat is required in application of this material and, after application, the road surface can be opened to traffic immediately. The lignin solution, as used thus far, ordinarily penetrates to a depth of one or more inches. The material mixes thoroughly with mineral aggregates, the water evaporates, and the legnin, reacting with the road soils, effects a dense hard mix which sets up within six to eight hours and seals the surface for ordinary weathering and traffic.

When used for dust treatment, light blading removes the coarse gravel, eliminates truck holes, etc. The road surface is then sprayed under twenty-five pounds pressure with Raylig.

Practical Uses

The penetration method usually makes it desirable to scarify the roadway to a depth of an inch or so to remove ruts, washboards and loose gravel, then light blading trues up the surface. The "build-up" method calls for a half gallon of the 26 per cent Raylig solution per sq. yd. for each shot which produces a mat from 2 to 2½ inches in depth. After several stages or courses, a final seal coat of ¼ gallon per sq. yd. is applied. Average construction and application cost with Raylig are as follows:

Dust treatment	$200.00 a mile
Double penetration	350.00 a mile
New construction	500.00 a mile

The cost of lignin binder is 5 cents a gallon at the mill. This is full 46 per cent solution. When mixed with water and cut to 26 per cent solution, the cost is 2½ cents per gallon. The New Jersey State Highway Department reports their cost to be approximately 8 cents per gallon for the diluted solution furnished, delivered and applied to the road surface. Other larger users are found in the States of Idaho, Maryland and Washington.

ORGANIZED YOUTH BUILDS ROADSIDE PARKS

Resume of Work on a Cooperative Enterprise of the National Youth Administration and the Texas State Highway Department

Building a Masonry Curb.

By J. REX RITTER

Assistant Division Engineer,
Texas Highway Department,
Wichita Falls, Texas.

Although ROADS AND STREETS *has consistently opposed not only the diversion of highway funds to non-highway uses but also (except as extreme emergency measures) the expenditures of such funds on highway "make-work" programs of low economic efficiency, it recognizes here an exception to the general rule. The editor knows nothing of the degree of efficiency attained on the work described by Mr. Ritter in this article, nor is he primarily concerned with it. The axiom that a nation's future lies with its youth was never more vitally important than to the United States in 1937, and it is right that every work-producing agency—public or private—should contribute what it can in wholesome employment to young men who otherwise must be faced with demoralizing idleness. This is in no sense a plea of "economic royalism," of the spirit that says "Keep 'em busy so they won't listen to the agitators": it is simply a recognition of the present importance of the fact known to thinking men since before the days of Solomon, that youth which is idle tends to become vicious. The man who knows useful work personally has a better perspective than any idler, and can better distinguish the good from the bad in the terrific changes now progressing and impending. The boys who build parks and roads on projects of the National Youth Administration, the Civilian Conservation Corps, or any other agency, are themselves being built into that better citizenry without which all our road building will count little.*
—Editor.

A DETAILED account of the results of the National Youth Administration's work program in this Highway Division would cover a sizeable volume. This discussion will, of necessity, be limited to include only the outstanding accomplishments of the two-year program completed on June 30th, 1937.

Division No. 3, of the Texas Highway Department, is located in north-west Texas, adjacent to Oklahoma, and comprises nine Counties, namely: Archer, Baylor, Clay, Cooke, Montague, Throckmorton, Wichita, Wilbarger and Young, with Division Headquarters at Wichita Falls. There has been an active N.Y.A. program under the sponsorship of the highway department in seven of the nine counties for the past two years. The selection of individual improvement projects under the program has been made to conform with a two-fold purpose, namely: the addition of worthy improvements to the highway system to widen the scope of service to the general public and to provide projects suitable for job training and interest on the part of the youths employed.

Perhaps the most noteworthy accomplishment has been made on the various improvement features on the division grounds at division headquarters. This work included sodding, planting flowers, shrubs and trees; building a native stone wall, constructing a greenhouse for propagation of flowers and trees for the whole division and building a naturalistic pool. The youth not only did a creditable job of lanscaping, but also received valuable training and instruction in landscaped design, proper planting methods and plant selection and cultivation. This

One of the "Pocket Parks" Built by N.Y.A. Forces Bordering a Main Highway in Texas.

phase of the work was carried on under the direction of our special planting foreman, who is skilled in matters regarding plant life. His scientific direction of the planting insured a successful job and also provided the youth with valuable instructions regarding proper methods in planting or transplanting various trees and shrubs. They were given short talks on which plants to move bare rooted and which must be balled with burlap. These discusions and lessons were invaluable in maintaining interest on the part of the youth for their job.

The greenhouse was built entirely by youth labor under the direction of the division carpenter. The work involved excavation for the cellar-like structure, forming and pouring concrete walls and floor, framing doors and glass roof, rubbing and finishing concrete, placing of reinforcing steel and building shelves and racks for plant propagation. Several thousand seedling trees have been started from cuttings and seeds; numerous varieties of flowers have been grown from seed for early transplanting to division grounds, county headquarters grounds and roadside parks. All the features of planned, permanent construction were incorporated in the structure and the participating youth received excellent training in both design and workmanship.

The naturalistic pool on the division grounds is a part of the general landscape plan. The pool is irregular in shape and is built of water-tight concrete. The side walls are corrugated to accentuate the irregular appearance. An artificial spring, issuing from native moss covered rocks, feeds the pool. A dense background of shrubbery completes the design. The whole plan was executed with youth labor. The work contributed to their store of knowledge on careful landscape design.

A low stone wall encloses the front of the division grounds. The work of quarrying the stone, hammer dressing and placing with mortar joints was all done with youth labor under the supervision of a skilled rock mason. Several of the youth engaged in the masonry work have shown unusual interest and talent in this phase of skilled workmanship and perhaps will later find private employment in work of this nature.

Another outstanding project now in progress is located on State Highway No. 5, west of Wichita Falls. This important east-west highway carries 3500 to 4500 vehicles per day and was recently improved and widened under the works program to provide for traffic needs. The road until recently had only 60 feet of right of way, and was adjacent to railroad property on the south and a highly improved suburban section on the north. For the construction of the works program job all widening was done on the south due to prohibitive costs in acquiring any additional right of way on the thickly built north side. Several schools are located along this suburban area, and there is extensive pedestrian travel, particularly school children.

Under the Wichita county-wide N.Y.A. program, a sidewalk project was proposed. The plans for this involved a ten foot additional right of way strip on the north side. Local sentiment in favor of this project as a means to safety and improvement in appearance was so strong that where previously the additional right of way could not be bought at a reasonable figure, the owners were now willing and ready to donate this right of way. The useful nature of the project, as well as the kindly feeling toward the aims and purposes of the National

Native Stone Bridge and Rock Lined Drainage Canal in Highway Rest Park West of Quanah, Harderman County Texas. This work, including stone walks, was done by N.Y.A. forces at a total cost of $2714.

Youth Administration, were paramount in this change of sentiment. The project is 11 miles in length and extends from Wichita Falls to Iowa Park. The walk is four feet wide, of local gravel with a crushed stone top. Four miles of the walk has ben completed, which covers the emergency part in the vicinity of the schools and the more populous section.

Other desirable features of the project are gravelling of side road approaches and mail box turnouts, filling deep ditches and sodding slopes, and an extensive landscaping program throughout the limits of the project. A pedestrian bridge of a permanent nature was constructed over a small creek. An interesting and instructive feature for the youths was the sinking of a minature caisson made from old barrels for the foundation of the middle pier, which was covered with water. The details and sequence of construction were identical with that of a large river bridge.

Another major accomplishment of the N.Y.A. is the development of twenty roadside parks in the division. This work involved the items of clearing, cleaning, planting shrubs, grass, flowers and trees; building walks, benches, tables and ovens of native stone; constructing driveways and rustic bridges, installing border fences of different types, and constructing dams for small reservoirs and retaining walls for embankments. These small parks have, in most instances, been donated and in each is erected a donor marker and a distinctive concrete marker indicating that the work was done by the National Youth Administration. The parks serve a useful purpose as places for recreation, picnics or rest spots for the weary tourist. The wide variety of the work has proved both interesting and instructive to the youth.

Recent changes in the program to permit greater flexibility has resulted in a wide variety of accomplishments such as landscaping entrances to towns, planting shrubs and trees at curves and other hazards on the highway to promote greater driving safety. Another noteworthy phase of the work has been the institution of means of erosion control by ditch retards and revegetation of slopes and ditches. This work not only provides greater safety and sightliness but will also result in lowered maintenance costs on the highways, as well as provide excellent training of the youth in the extensive field of general erosion control.

A Completed Pool and Other Work of the N.Y.A. in a Roadside Park near the City of Austin.

In all the counties, the highway section foreman acts as project superintendent, and his patience in dealing with the youths through persuasion, rather than threats or force, has contributed in a large sense to higher morale, a feeling of pride and responsibility in the job, and a keener sense of ability and self reliance. Numerous private placements have resulted from the training received, and numbers of the youths are now making good in outside employment.

Briefly the program of the National Youth Administration in this division has resulted in many outstanding accomplishments that could not have been either undertaken or attained without the excellent service rendered by the youths, and the hearty co-operation of the administrative officers of the N.Y.A. The service to the public has been augmented through their efforts. The participating youths have and are receiving valuable job training, which will prove of untold help in meeting competition of private employment.

▼

James Lloyd Kimbrough Dies

James Lloyd Kimbrough, organizer and first president of the American Institute of Steel Construction died July 9, 1937. He had served the Institute ever since it was organized, first as President and then as a member of its Directorate.

Mr. Kimbrough's business positions in the steel construction field included the presidency of Indianapolis Bridge Co. and the vice presidency of the Muncie Malleable Foundry Co., but his broad abilities had lead him also to corresponding positions in organizations outside the steel industry.

The following tribute by W. M. Wood, president Mississippi Valley Structural Steel Co., and Past-President of A.I.S.C. was published in "The Steel Constructor" for August.

"In the passing Lloyd Kimbrough, the Institute has suffered another great loss. He served us long and well. Whether as the first President, as director, or as a member of the Executive Committee he freely gave of his time and his talents and, quite largely, his conception of what the Institute should be and do is manifest in the record of both past and present.

"His ability to analyze any problem was unusual and his thinking always clear and rational. By nature conservative and deliberate he was slow in adopting new and untried policies, insisting upon most thorough scrutiny first.

"As a diplomat, he was a past master. With his pleasing personality, his ability to express his thoughts most convincingly, whether through the spoken or the written word, he had great power in bringing men to his way of thinking.

"But above all else, Lloyd will be remembered as a friend. Willing to make any sacrifice for those he loved, jovial, clean, whole souled, unselfish and true, it was a pleasure to be with him and an honor to count him as your friend."

▼

HIGHWAY SAFETY TO BE GIVEN ATTENTION AT MAINE SAFETY CONFERENCE: One of the principal addresses of the Annual State Safety Conference of Maine will relate to highway safety problems. The meeting will be held at the Eastland Hotel, Portland, Maine, October 21 to 22.

OBSERVATIONS BY THE WAY

By A. PUDDLE JUMPER

¶ What is going to be the outcome of this tendency toward development of craft unionism in highway work? It seems to me that if this movement is successful it will result in the curtailment of many miles of road construction. Increased costs and labor delays usually attend projects that are unionized.

• •

¶ A good ruling which should pertain to all construction in the highway field is that a contractor should be required to do 80 per cent of the work with his own forces.

• •

¶ Note the drag on the rear end of the Hawkeye motor grader at work on U.S. 281 south of Grand Island,

Nebr. I'm told that all their motor maintenance machines carry the drag.

• •

¶ And another thing badly needed is a lot of diagonal highways in prairie states and elsewhere where section line roads prevail.

• •

¶ The diagonal of a square is just 71 per cent of the distance around two sides. Figure for yourself the gas, oil and time savings some good diagonals would make.

• •

¶ Southern California has some good highways, but their signing is inadequate. The state might well look over signing of Wisconsin, Ohio, New Jersey and Massachusetts.

• •

¶ The traffic problem of Los Angeles certainly needs study. It will not be long before some action will have to be taken to expedite movement during daytime hours as well as rush periods of the morning and evening.

• •

¶ Apparently other motor vehicle drivers felt as I did when I came to the stop sign pictured here. Two trucks and two passenger cars passed me without stopping. This is a circle arrangement ahead on U.S. 422 out of Cleveland a ways toward War-

ren, Ohio. A senseless, useless stop sign. Next time I go that way I'll disregard it too.

• •

¶ The Colorado State Highway Department has all the earmarks of an efficient organization.

• •

¶ If your car heats up when you get into the Rockies, provided you come from the East or Middle West, you can charge it to the altitude until you get the carburetor adjusted.

• •

¶ Ohio survey crews in Div. 4. Headquarters at Ravenna, believe in giving all protection possible to sur-

vey crews. Note how legs of this transit tripod are painted. Easy to see and a good idea, I claim.

• •

¶ What causes water at certain times, to come up through a pavement from underneath and run over the surface?

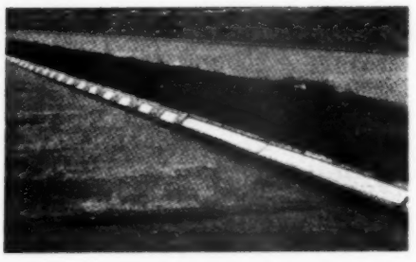
• •

¶ Maybe the Port of Entry idea is O.K. It certainly leaves a "bad taste in my mouth," so to speak. One gets anything but a Courtesy Patrol feeling from grim-faced officers.

• •

¶ Leading British highway publication called "Roads and Road Construction" carries a two-page section, similar to these pages, entitled "Round and About" by "Major Roadahead." In them I found the following notes and picture:

Mr. W. P. Robinson, County Surveyor of Surrey, showed us some of the trial sections of kerb which have been laid on the Kingston By-Pass. The object of the experiments is to find some relatively permanent means of



increasing visibility at night or in fog. For this purpose Mr. Robinson is making use of glazed tiles let into the face of the kerb. Various angles of batter are under test and tiles have been inserted singly and in a continuous formation. We understand that a bituminous matrix is used for fixing the tiles to allow for differences in expansion of the kerb and the tile.

• •

¶ Tiles fixed to concrete blocks and white glazed bricks are also being tried out on the Kingston By-Pass for marking the traffic lanes. As the traffic is almost wholly pneumatic tyred the risk of fracture should be small.

• •

¶ Traffic Line Marking Machine in Division B (Fayetteville, N.C.), North Carolina State Highway Department.

It was made by the State Highway Department of which B. W. Davis is equipment engineer.

¶ Why all the secrecy about New Mexico highway work, Mr. Conroy?

• •

¶ Whether to be intentionally different or not, the State of California and cities in the Los Angeles region use red octagonal stop signs instead of the standardized yellow signs.

• •

¶ A few miles south from New Mexico's trappy looking Port of Entry on U.S. 80 near Anthony, N.M., is the Texas State Highway Department's road information station. No Port of Entry idea here. The one thing amiss, that I noted, was that no American flag flew from the flag pole.

• •

¶ South of Sante Fe on U.S. 85 on way toward El Paso, Tex., there is a miserable stretch of 40 miles of gravel. It seems to me only fair for thickly populated Eastern States to help toward building surfaced roads in these mountainous states. We, in the East, should grant a greater federal aid. These thinly populated states have miles and miles of road through territory on which jackrabbits nearly starve. I vote more aid to mountain states for highway surfacing.

• •

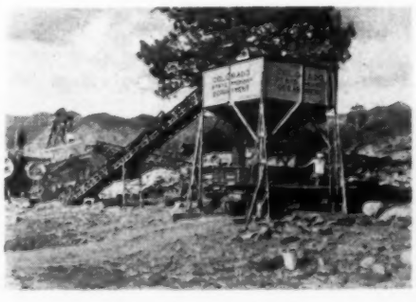
¶ A stranger traveling roads south of Los Angeles at night needs a sixth sense to keep from running around in circles. The highways are poorly marked.

• •

¶ What about our old style bridges? Truck manufacturers are building units heavier and larger day by day. Many our our old bridges were designed and built for trucks of which wartime models were considered heavy.

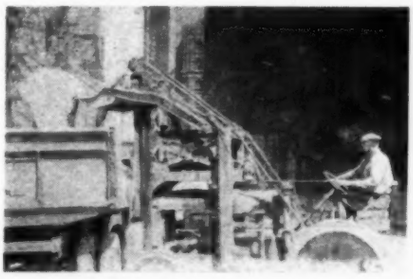
• •

¶ This neat Colorado state highway department crushing and screening plant was preparing materials for



a mountain road near the Continental Divide north of Chama, N.M. The rock surfacing was a valuable addition to the highway as a preparation for bituminous surfacing.

¶ Guide rail protection bumper put on a Trackson loading scoop by the



contractor. The operator says it saves him a lot of grief and time in loading trucks.

• •

¶ I have just returned from an 11,200 mile trip through the Western states. I visited the state highway departments and contract jobs. You will note articles prepared as a result of this trip appearing from time to time. All of these engineers were extremely cordial and cooperative. I take this opportunity to thank them.

• •

¶ California state highway maintenance unit at work. These trucks are so equipped that snow plows or push blades may readily be mounted.

Here the gang is removing rock slides that occur in places on the pass through the mountains between Los Angeles and the San Joaquin valley.

¶ To find out how not to build a concrete pavement just drive over that short stretch up the hill east out of Chamberlain, So. Dak.

• •

¶ I visited a brick pavement job in Randolph, Nebr., on which I worked in 1920. I asked a couple merchants how they liked the paving. They spoke highly of it and were very well satisfied. The pavement is not quite as smooth as when finished but it is nearly so. On this job we used the offset crown to compensate for curbs at different elevations.

• •

¶ Compliments to the Nebraska State Highway Department on their concrete paving. They have some good work and good alignment.

• •

¶ It was certainly good news to hear Chief Engineer Baldock of Oregon say that the patching crews on the coast route, U.S. 101, in southern Oregon, were preparing the road surface for a surface treatment job. The patches the crews made are rough and unfinished.

• •

¶ What's behind the move in Iowa that resulted in adoption of a special provision in the paving specifications eliminating the use of the new 34-E dual drum Koehring paver? We guess that the boys have put on the heat. We also note that tandem operation is also prohibited. The Western Asphalt Paving Corporation of Sioux City, Iowa, now has this unit on their hands and no use for it.

• •

¶ There's considerable criticism in Sioux City about that new long viaduct. No ramps were built into it and the Stock Yards people don't like it. The viaduct is about 4800 feet long.

• •

¶ South Dakota has painted the handrails on many of their concrete bridges and concrete guard rails with aluminum paint. They loom up nicely in the dark and look good, too.

• •

¶ Montana has just about completed the first stage in their highway improvement program, that of making the roads dustless and mudless. They are now planning a modernization program. They need it too.

• •

¶ I noticed several contractors hauling Le Tourneau scrapers in tandem on some of those western highway jobs.

FIVE STAR
ROAD SHOW and CONVENTION
Cleveland, Ohio
January 17-21, 1938

ROAD BUILDERS'

SEPTEMBER, 1937 **AMERICAN ROAD BUILDERS'**

NEW MODELS GALORE

Down the Road

By CHARLES M. UPHAM

Engineer-Director, American Road Builders' Association, Washington, D.C.

THE YOKE OF DIVERSION

Uncle Sam has penalized the state of New Jersey to the tune of $250,000 for the misappropriation of highway-tax funds by the state legislature. These funds were collected from automobile owners and intended solely for the construction and maintenance of New Jersey highways. What does this statement mean to the American motorist at large?

American citizens love their liberty. They frequently boast that they "wear no man's collar." The collar, or yoke, in by-gone days, designated servitude to a master by the one who was forced to wear it. The collar, then, as a symbol of servitude, has been handed down through the years and Americans do not like the idea of being thought of as collar-wearers, as servants to any master. They resent being placed in the same category with a dumb animal whose collar is part of the harness by which his master makes him perform certain tasks. Yet there are in this great nation of ours where freedom is so highly prized, despite the wide use of this characteristic boast, a vast number of American citizens who are harnessed to the whims of unconcerned politicians. These politicians do not seem to care where the taxpayers' money goes as long as the "proper" parties are pleased. The American motorist uses the highways more than 440 hours each year and works approximately 120 hours a year to pay for that privilege. Twenty-eight million strong, they are the citizens who have been collared into servitude by the actions of irresolute legislators.

Everyone for himself and the devil take the hindmost used to be the attitude of the highway taxpayers concerning the condition of the highway. The outcome of that attitude was that the devil took the highway. By "the devil" I mean the diversion of gasoline taxes and other motor-vehicle revenue to non-highway purposes.

When "the devil" began taking the whole highway program, as well as the "hindmost" part of it, Uncle Sam took the situation in hand. Most important consequence of the government's action was the passage of the Hayden-Cartwright Road Act on June 18, 1934. Section 12 of this act provides that any state that diverts gasoline taxes and other motor-vehicle revenue from highway purposes in greater amount than provided by law on the date of the passage of the act shall be penalized not to exceed one-third of the federal-aid funds made available to that state in any year.

The diversion of gasoline taxes and other motor-vehicle revenue to non-highway purposes has, therefore, been tried by the highest tribunal in the land next to the Supreme Court and has been found guilty. The Congress of the United States has labelled the practice of diversion by state legislatures as "unfair and unjust."

FASHIONS IN HIGHWAY-WEAR ARE YEARS AHEAD IN ECONOMY AND EFFICIENCY

Sensational new models of streamlined machinery designed to do better work at less cost will feature six acres of exhibits at the 1938 Road Show and Convention of the American Road Builders' Association in the public auditorium, Cleveland, Ohio, next January 17-21. These exhibits will "model" the "fashions for 1938" in highway-building equipment and materials, as road-builder spectators from 48 states and 25 foreign countries, numbering more than 20,000, look on. They will witness the "latest creations" in power shovels, paving mixers, finishing machines, tractors, trucks, crawler wagons, compressors, graders, rollers, engines, guard-rail and other new developments in equipment and materials.

State, county and city highway officials; highway engineers and contractors, manufacturers and their distributors, who plan to attend, will all find in the 1938 Road Show's preponderance of novel exhibits a refutation to the old saying, "There's nothing new under the sun!"

In addition to the "fashion show" of new machinery models, the convention itself will be a lavish presentation of uncommon activities for roadbuilders, with features on currently vital problems and the promise of something pleasingly "new" in the way of "get-togethers." In fact, those who plan the entertainment end of the A R B A Convention-Road Show shake their heads mysteriously and simply say, when asked, "It will dazzle even the oldest eyes present—wait and see!" Sessions of the convention program will include authoritative discussions on highway safety, soil stabilization, gas-tax diversion, highway planning, education of highway engineering students, development of highway construction

REVIEW

FIVE STAR
ROAD SHOW and CONVENTION
Cleveland, Ohio
January 17-21, 1938

ASSOCIATION—WASHINGTON SEPTEMBER, 1937

AT 1938 ROAD SHOW

COMPLETED GUARD-RAIL REPORT EXPECTED BY CONVENTION TIME

A special meeting of the Problem Committee on Guard Rail, a sub-committee of the Committee on Safe Highways of the American Road Builders' Association, met in Washington, D.C., August 25, 1937, at the Willard hotel. O. F. Goetz, committee chairman and chief engineer of the Tennessee Department of Highways and Public Works, was unable to attend and Arthur F. Ranney, county engineer, County of Summit, Akron, Ohio, was elected to serve as chairman pro tem.

Members of the committee present, besides Mr. Ranney, were H. T. Moore, president, Tuthill Spring Co., Chicago, Ill.; E. V. Camp, president, National Traffic Guard Co., Atlanta, Ga.; J. E. McCracken, Bethlehem Steel Corp., Bethlehem, Pa.; J. J. Forrer, assistant engineer, maintenance division, Department of Highways, Richmond, Va.; H. G. Sours, promotional engineer, Truscon Steel Co., Youngstown, Ohio; C. A. Young, Sheffield Steel Corp., Kansas City, Mo.; George Rahn, research engineer, state highway department, Harrisburg, Pa.; Frank Bemis, American Steel & Wire Co., New York, N.Y.; Robert M. Reindollar, assistant chief engineer, Maryland State Roads Commission, Baltimore, Md., and Roger M. Kyes, General Wheelbarrow Co., Cleveland, Ohio. Others present were Charles M. Upham, engineer-director, American Road Builders' Association, Washington, D.C.; J. L. Cole, General Wheelbarrow Co., Cleveland, Ohio, and Burton F. Miller, American Road Builders' Association, Washington, D.C., acting secretary of the problem committee.

The initial meeting of this problem committee was held in Washington, May 27, 1937, in conjunction with the annual meeting of the A R B A and was entirely devoted to the consideration of guard-rail standardization. An abstract of the proceedings of this meeting has been mailed to committee members. In addition to standardization, the functions of this group include studies to determine the effectiveness of guard rail as a barrier against the vehicle leaving the road, as well as against overturning; the increase of roadside visibility by the use of guard rail, the degree of protection afforded the occupants of the vehicle and the effectiveness of guard rail in preventing damage to the vehicle. These studies, with their consequent recommendations, will also determine the location of highway guard rail.

Other members of the committee who did not attend the August 25 meeting are Charles Cope, supervisor of route marking, state highway department, Ravenna, Ohio; E. Jack Smith, state highway engineer, state highway board, Macon, Ga.; A. C. Tilley, state engineer, Department of Roads and Irrigation, Lincoln, Nebr.; V. L. Glover, engineer of materials, Illinois State Highway Department, Springfield, Ill.; C. W. Siniff, engineer of maintenance, state highway commission, Indianapolis, Ind.; E. B. Cavallo, construction engineer, state highway department, Jackson, Miss.; J. E. Boyd, testing engineer, state highway board, Atlanta, Ga.; J. L. Cresap, vice-president, Flexplate Guard Rail Co., Tallahassee, Fla., and W. H. Bleecker, sales manager, Page Steel & Wire Division, American Chain Co., Inc., Monessen, Pa.

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equipment, highway legislation, federal-aid benefits for secondary roads and municipalities, contract system in highway work, highway illumination and federal rules and regulations for highway work.

The annual Road Show and Convention of the American Road Builders' Association is the periodic meeting place and proving ground of the highway world. It affords road builders their only opportunity to inspect and compare the merits of all types of road-building equipment and materials at one time, under one roof. It is the only "Five-Star" production in the world for a purely highway-minded audience. The 1938 edition in Cleveland, Ohio, January 17-21, is going to be crowned the all-time, all-around champion of the highway world and the "gate" is going to break all past attendance records for this championship event.

ILLINOIS ROAD BUILDERS AFFILIATE WITH ARBA

Members of the Illinois Road Builders' Association met in Chicago, Ill., August 17, 1937, and unanimously voted to affiliate their organization with the American Road Builders' Association. The officers of the Illinois Road Builders' Association are Herbert R. Anderson, president; Peter J. Crowley, vice-president; Henry Fowler, secretary, and A. S. Holway, treasurer. Directors are Lyman B. Tichenor, Robert G. McKay and John B. Sackley. The affiliation of this group of road builders is the ninth for the American Road Builders' Association since the first of the year and the highway-contractor membership of the A R B A now totals close to 1,400, according to W. C. Slee, assistant engineer-director, American Road Builders' Association, who represented the national organization at the Chicago meeting.

WHO SHOULD PAY FOR THE HIGHWAYS?

A General Survey of the Benefits and Obligations of All Parties

By ROY F. BRITTON
Director, National Highway Users Conference

An Address Before the Annual Convention of the WESTERN ASSOCIATION OF STATE HIGHWAY OFFICIALS, Denver, Colorado, July 21, 1937

IT IS really a great privilege to address the members of this important organization. You gentlemen are responsible for the exercise of one of the most important functions of modern government. Motor transportation is so definitely related to our daily life, our standards of living, and generally to the economic and social welfare of all the people that whatever you do has a very direct effect on our national progress.

I am indebted to my friend, Mr. Baldock, for this opportunity to present my interpretation of the viewpoint of the highway users on future highway programs. The users are important, not only because the facilities are provided for them, but also because they are paying the bill for the construction and maintenance of most of the roads under your jurisdiction.

In order to evaluate the present situation and estimate the future trends, it might be well to first paint the background and briefly review the history of our country's highway development.

Historical Background

The history of the better roads movement in the United States falls into three distinct periods.

There was the period devoted largely to the creation of sentiment, when, with but a few motor vehicles on the roads, a handful of us here and there was as voices in a wilderness of mud. The production of automobiles at reasonably cheap prices and in large volume brought new advocates to the cause.

Then came the second phase devoted mainly to the development of ways and means of securing money wherewith to build roads to meet popular demands. It was clear that the old financing methods, based on property taxes and special benefit assessments, would not suffice. The motor vehicle owners themselves thereupon devised a system of taxation based, first, on registration fees and then on gasoline taxes, which became the very foundation of the American road structure as we know it today.

Sentiment having been developed and ways and means found, we arrived at the third phase, namely, the period of actual road building, which has already resulted in the improvement of more than one million miles of American roads.

Like some of you here today, I was rather closely associated with all three phases of this movement. I am, therefore, familiar with the splendid achievements of our state highway engineers and officials and the United States Bureau of Public Roads. Working together, taking advantage of every scientific development and every technical improvement. they converted trails into highways over which our people have marched toward a larger and better life and over which our business and commerce advanced to new conquests.

Accomplishments

This building of yours was a big business in the biggest sense of the term. And in these times when every day is an open season for sniping at big business, you road officials and engineers can well be proud of the fact that your expenditure of billions of dollars of public money has not only been intelligent and fruitful, but has been singularly free from the type of scandal that so often attaches itself to major public works.

The development of our highways to date, is the outstanding advance in America's social and economic progress in the Twentieth Century. These roads have remade the habits of our people and revolutionized our business. They have integrated this country of ours as nothing else could have done. They brought countless communities and millions of people out of isolation. At the moment, no less than 48,000 communities in the United States are without any facilities of transport other than the people's highways. These highways have brought the city to the country and the country to the city. They have extended our educational facilities. They have done more to destroy sectionalism than any other instrumentality of our time. And, on the material side, they have re-created America industrially. They even brought new products into existence and made other products available to millions for the first time. They developed wider and speedier methods of distributing the output of industry and the output of agriculture. They built new communities.

Close these roads, or let them fall into decay, and you bring the social and economic life of the nation to a virtual standstill: the suburbanite on his way to his office; the housewife on the way to market; the bus carrying children to school or passengers from one community to another; the truck loaded with fruit, fresh vegetables, live stock, milk, bread, and other necessities of life, or with newspapers and magazines; the doctor on his errand of mercy;

THE *New* INTERNATIONALS

Buys Fleet of 10 *NEW* INTERNATIONALS

Based on the performance of their other International Trucks, the Brennan Paving Co., Ltd., Hamilton, Canada, recently purchased 10 NEW 2 to 3-ton Model D-40 Internationals like the one above. Their fleet now consists of 19 Internationals.

Other sizes in the International line range from the Half-Ton unit in the low-price field up to rugged Six-Wheelers.

International Harvester produces no "yearly model" changes in trucks. A new line is not just a matter of the calendar with this Company. It is interested only in keeping International trucks at top efficiency.

The International "C" models, now on the highways in many tens of thousands, are living evidence that this policy gives the truck user what he needs for hauling satisfaction. There have been no better trucks on the market, but *now* there are better trucks by far—these new Internationals.

The International reputation has advanced steadily on performance and long life, on unequaled nation-wide service, and on the truck user's final objective—ECONOMY.

In the meantime, International has been constantly at work on engine and chassis design, load distribution and braking, increased power, fuel economy, and driver comfort. The resources of its engineering staff, its laboratories, its plants and proving grounds were centered in the development of a fundamentally better product. Today the many improvements are consolidated in this *completely new* line of trucks.

Today International Harvester offers truck users the finest value of the year, a product *engineered* to the moment and *styled* for public acceptance. These new trucks are on display at any International branch or dealer showroom.

INTERNATIONAL HARVESTER COMPANY
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the ambulance on its way hospitalward; the traveling salesman on his mission of commerce; the mail carrier—the "pony express" of the modern postal system. It is hardly necessary that, with a group like yours, I should dwell on the overwhelming manner in which the highway has proved its case.

We Are Past the Age of Haphazard Improvement

It was but natural that the main trunk lines were first improved. They serve a majority of the people. They connect the principal population centers from whence come the largest portion of the revenues. They are the principal farm-to-market roads. The building of these highways was of great benefit to the Western States for as they were connected into transcontinental routes, they furnished the ways over which hundreds of thousands of tourists have poured into recreation and scenic centers of the West—many to stay and become your citizens.

And now you are faced with the problem of rebuilding some of these main trunk lines to modern standards and at the same time turning your attention to the secondary or feeder roads and to arterial streets in cities. It is a great responsibility that rests upon you. The proper solution of the problem will depend upon careful planning and scientific selection of the roads to be improved. We have reached a point in the construction stage where additional building must be based on economic justification. Indiscriminate building must be entirely avoided.

In the early days, highway building was necessarily somewhat haphazard. Information as to potential use and economic data was lacking so roads were located according to someone's opinion of where they should go, and taxes were fixed by someone's guess as to what the rates should be. It is remarkable that out of such a system we have the great highway development of today. That is due to the ability, to the sound practices and professional skill of highway officials and engineers. All of this gives us great confidence in the future.

It is fortunate that today it is not necessary to depend on guess work in our future planning. The state-wide highway planning surveys set up by the United States Bureau of Public Roads in cooperation with the state highway departments should develop the factual information on which rational, long-range highway programs can be based. Such surveys are in progress in all of the Western States. If intelligent use is made of this information, if the proper principles are applied, we are assured of orderly development of highway improvement in the future.

How Shall Costs Be Distributed?

Where shall we get the revenue for such programs. For what roads and streets should the motor vehicle owners pay, and what thoroughfares should continue to be a charge on the local communities?

There is a generally accepted formula. It is that motor vehicle owners, through their special user taxes, should pay the entire cost of constructing and maintaining the state highways (less Federal Aid) and part of the cost of local roads and arterial streets, that part to be determined by the extent to which such roads and streets are in general use rather than local use. The theory of this formula is that the state highways carry a major part of the traffic of the state although they constitute a small percentage of the total road mileage. They are in general use, serving the state at large. As the special taxes come from the motor vehicle owners of the whole state, it is proper to pay from this revenue for the construction of these main trunk lines after giving effect to Federal Aid. The Federal Government's contribution is justified because of its monopoly of mail carrying and because of its obligation to provide for the National Defense.

Motor vehicle owners are not the only beneficiaries of street and highway construction and, therefore, after meeting their obligation to pay for the main thoroughfares, they should not be called upon to pay all or any great part of the cost of other roads and streets. There are many miles of local roads and streets the construction of which always has been and always will be the obligation of local communities.

Who benefits from improved roads? Certainly the community as a whole benefits because of increased facilities for communal life, police and fire protection, and access to schools, churches and places of business. Certainly the adjacent land benefits because of increased value and accessibility to markets. Certainly the National Government benefits from a military and mail distribution consideration. Certainly the great utilities of the country benefit because highway improvements make for easier construction, maintenance and service of their transmission lines. And certainly the roadroads benefit because practically all of their freight and passengers reach and leave the rails over streets and highways.

It is plain, therefore, that the cost of highway and street improvement should be fairly allocated so that all beneficiaries will bear their just proportion. The highway planning surveys will implement the formula of taxation to which I have referred.

We must constantly bear in mind that a highway system built from motorists' special taxes must necessarily be a limited system. The problem is one of selection. The planning surveys will present accurate information as to the service of various classes of highways and streets to agriculture, business, property, education and other interests. Thus the problem before you will be somewhat simplified.

The groups associated with the National Highway Users Conference are looking forward to the time when all of this information will be available so that they may cooperate with the Bureau of Public Roads and the highway departments in the planning of future programs.

The Factor of Ability to Pay

However, from every point of view, one thing is quite clear: The highway requirements of a state cannot be the only measure of the motor vehicle owners' taxes. Serious consideration must also be given the motor vehicle owners' ability to pay. A diminishing stream of revenue will flow from exorbitant taxes. The rates must be adjusted to encourage and extend motor vehicle use of all kinds. The motorists' tax structure must be carefully studied in each state and reasonable productive rates determined for all classes of vehicles.

Then, too, before we embark on ambitious programs, first consideration should be given to maintaining the highways which are now improved. We all have an obligation to properly maintain that which we now have. We must know what this is costing the motor vehicle

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—says George M. Shepard, Chief Engineer, Department of Public Works, St. Paul, Minn.

Virginia Avenue, St. Paul, Minn.

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owners. For the country as a whole it is estimated that the cost of administration, maintenance, policing, and bond service averages more than $20.00 per car. In other words, just to stay where we are—just to properly keep what we have—costs every automobile owner in the country at least $20.00 per car. When you consider that the average motorist is a man of limited means this is a significant contribution. If you do not think it is a substantial levy, try to take up a voluntary collection of $20.00 per car from the motorists of the country and see how far you will get, worthy though the cause may be.

Now, the motorist must pay through taxes for the construction of every added mile and he must also pay the increased annual charge for administration and maintenance. Therefore, in the development of new programs, it is essential that we take into the calculations the estimated annual cost of maintaining and administering each projected increment. It is of the utmost importance that the cost of the extended system shall be kept well within estimated revenues to be produced by reasonable rates of taxation, otherwise the structure will bog down and existing roads will suffer from inadequate maintenance.

In each state the average charge per car for administration, maintenance, policing and bond service should be ascertained as a starting point. Then the charge per car to provide the revenue needed for additional roads should be determined. If you arrive at a figure that is prohibitive for the average motor vehicle owner, or a figure which will restrict or depress motor vehicle use, you have reached the danger point. If you insist upon such a figure, certainly you will harm the cause and endanger your program.

The ability of the motorist to pay should not be judged by those in the higher income brackets. The automobile has long ceased to be a convenience of the privileged classes. It is a vehicle of utility of the masses, a necessity to our modern standards of life. Therefore, the average automobile owner's ability to pay should be the yardstick of the assessment. Most of the passenger cars are owned by people in the low income brackets. In 1933 the United States Department of Commerce found that 33 per cent of the automobiles in use at that time were owned by families whose annual income was below $1,000; and 90 per cent by families with incomes of less than $3,000. These are the people who are furnishing the bulk of highway revenue today. We must depend upon their special motor taxes for progress in the future. Therefore, highway programs must be planned and taxes adjusted to fit the means of the average family with an extremely moderate income.

Safety Can Not be Slighted

There is another great responsibility which must be discharged before we embark upon ambitious plans of extended mileage. We must continue to build safety into our highways. We must continue to utilize the advancements in the art of design and use to the best advantage all of the discoveries of research.

But engineering skill can never make up for human frailties. There is no such thing as a "fool-proof road." The driver is still the major cause of accidents. It has been demonstrated that in the hands of a careful and prudent driver, the modern car can be operated with safety over any kind of a road or street. The highway is rigid; it is built to endure; and it would be a tremendous and unnecessary waste to reconstruct many miles of highways for the benefit of careless and irresponsible drivers.

However, constantly increasing congestion and the development of vehicles of greater speed call for rebuilding or improving some of our existing facilities. I am sure that the highway departments will build into our modern roads the greatest possible degree of safety.

Sane Suggestions for Future Policies

As to general policies in the future, a sound and progressive point of view is expressed in the Tenth Biennial Report of the Missouri State Highway Commission, as follows:

"We need the viewpoint of the transportation economist rather than the restricted one of the technician skilled only in construction methods. We need to be able to decide correctly when the road is best adjusted to the traffic—adjusted so that the annual return to the road users will be a maximum, and so that one road dollar will buy as much as any other road dollar. We need economic criteria to guide us in the planning of a highway system. We need a measure of road efficiency. We need basic information concerning the traffic—the type, weight, and number of motor vehicles passing over the road, where this traffic originates, and where it wants to go.

"Unlike the motor vehicle a road system cannot be discarded and replaced with a new and up-to-date model every year, but a road system built over a period of years, however, affords the opportunity in each succeeding year for improvements in the successive increments to the road mileage. Each succeeding increment should be better adjusted to the growing needs of the traffic than the preceding one. Experience is accumulating, research work is expanding, judgment is becoming seasoned, and foresight sharpened. If we are to have a highway system yielding the largest returns to the motor vehicle owners, we will have to give heed to the underlying principles of economic highway planning."

Taxes Must Not Be Diverted

I am sure this represents the viewpoint of most highway officials and engineers. The using and tax paying public looks to you confidently for the development of economically sound and well balanced plans for the future. There are three distinct threats to such orderly procedure:

First, diversion of special motorists' taxes to other than road purposes. You are all familiar with the evils of such a practice. From the users standpoint, it is most unfair. No matter what these other purposes are, no matter how necessary or praiseworthy they may be in themselves, be it the general support of the government, unemployment relief, education, or whatnot, they manifestly constitute a general obligation on the state and the community as a whole and should be supported from general taxes to which the motorist contributes his share in his capacity as a general taxpayer.

The gasoline tax is a tax by the mile and it is justified when the proceeds are used for necessary highway construction and maintenance; but when diversion is practiced, it becomes a sales tax on a special class, a discrimination and a mockery. The distance that a citizen travels is not a proper measure of the taxes he should pay for the general support of the government, for education, relief, or any other purpose except highways. In some of the Eastern and Mid-western States, for a time diversion was rampant. On the whole the Western States have a good

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record in this respect. Some of them have never diverted special motorists' taxes. Others are only mild offenders.

A few years ago, following the example of Missouri, Kansas and Minnesota, the people of the State of Colorado adopted a constitutional amendment prohibiting diversion in that State. During the past few months similar amendments have been passed by the Legislatures and referred to the people in California and Nevada. Wherever the proposition has been submitted to the electorate as a single issue, the vote against diversion has been overwhelming. Every effort should be made to secure the adoption of these amendments.

The Rights of Main Highway, City Street and Local Road

The other two threats may be considered together because the same principle is involved in both of them. These are the demands of some of the cities for an unreasonable share of state funds for streets; and also unjustifiable demands for expenditure of state funds on roads of purely local use.

It is conceded that the motorists should share in the cost of building arterial streets and local roads, carrying general use traffic; but if the distribution of state funds is extended to purely local thoroughfares, there is real danger of depleting the funds necessary for general use highways or of overtaxing the motor vehicle owners.

On behalf of the cities, it is often contended that much of the revenue comes from the owners of vehicles in metropolitan centers and therefore more should be expended in the cities. Against this may be balanced the fact that the largest users of state highways are the urban residents. Nor is there any doubt of the great service which our highways render to the cities.

Many of the local roads are in the same category as city streets. They serve only local purposes and should be built at the cost of the beneficiaries. Of course there are some secondary and feeder roads, carrying a large volume of general traffic, which should be considered the obligation of the state as a whole.

The Evil of Wild Promises

In some places absurd representations are being made for political purposes. Wild promises of enormous mileages of farm-to-market roads are being made. It is a cruel injustice to the farmers to hold out such false hopes. Simple arithmetic will demonstrate that the motorists cannot possibly pay the cost of such extravagant and indiscriminate building. We must be realistic.

Secretary of Agriculture Wallace recently said:

"Obviously those secondary roads should be chosen which will serve the most people. There are many hundreds of thousands of miles of road which cannot be touched in any way at any time in the near future. We want to tackle those secondary roads which will feed the most traffic into the main roads and into the railroads. We don't want to waste money trying to improve roads which wander miles away from the main roads, serving two or three farmers on land so poverty stricken that they are fighting a hopeless battle."

The Lighting Problem

There are other demands for participation in the motorists' tax funds. Some of them are obviously without merit, others must be thoroughly studied. Some important questions are raised by the proposals for extensive highway illumination in the interest of safety. The installation of lighting is costly and its operation is even more expensive. With limited funds available for road uses, the first question to be decided is whether or not each unit of expenditure proposed for lighting could be used to greater advantage in saving lives both day and night. Certainly there should be careful research and experimentation before any extensive lighting programs are seriously considered.

Commercial Vehicles and the "Subsidy"

A few words about so-called "highway subsidy" may be in order. The loose talk of "subsidy" as applied to highway transport is wholly without basis of fact. Whatever facts we have point the other way. And besides, the use of the term "subsidy" in connection with highway transport is wholly inapplicable. As commonly understood and as any good dictionary will vouch, subsidy is "a grant by government to a private enterprise." The highway is not a private enterprise. It belongs to all the people, as contrasted with all other facilities of transportation which are privately owned. Nor can the use of special motorists' taxes for highway construction and maintenance be regarded as a government grant. It is to be suspected that the use of the term is a mental throwback to the days when Federal, state, local, and municipal governments were actually subsidizing other forms of transportation, including railroads and canals.

I am aware, of course, that the charge of subsidy is particularly directed at commercial vehicles. Here again we need facts. Some established facts, however, should not be overlooked. It is asserted that trucks and buses are making a business use of the highways. The private passenger car is also used a large part of the time for business purposes; that is, it is a commercial car in the same sense that the privately owned truck is a commercial car. Roads and road standards have been established primarily to meet general traffic needs, including speed and volume of traffic, and also to withstand the effects of climate. There is a definite tax limit beyond which commercial operation is killed, thus resulting not in an increase of revenue but in a substantial loss of revenue.

In the aggregate, trucks and buses today pay a very substantial special tax. These vehicles constitute approximately 13 per cent of all the registration and pay approximately 25 per cent of all taxes. More specifically, the Bureau of Public Roads made a careful survey of the taxes paid by all classes of vehicles in 1932 and found that year all of the trucks and buses paid $215,000,000 in state registration fees, gasoline taxes, and special fees. The cost of maintaining the state-administered systems of all the states amounted to $169,479,399 in that same year. The taxes paid and the cost of maintenance have, of course, increased since 1932, but no doubt the ratio remains the same. In other words, commercial vehicles are paying more than the cost of maintaining the 300,000 miles of surfaced roads over which perhaps more than 75 per cent of all for-hire operations are conducted.

Conclusion

But however, this may be, we must in the immediate years ahead make a real attempt to reach an equitable understanding as to what proportion of the highway tax load should fall on the various classes of vehicles, and

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data that may prove helpful in this effort may be expected from the planning surveys.

With surprisingly few exceptions highway departments enjoy the confidence of the public. That confidence is deserved. It has been well earned. In order to be successful, future programs must have public support. There will be much more discrimination and careful appraisal on the part of the public in the future than there has been in the past. Motorists are tax conscious. They want roads and are willing to pay for them; but they want them economically constructed and maintained, they want them built to fit traffic needs, and they want fair and reasonable rates of taxation. Your performance in the past is a guarantee that sound procedure will be followed in the future.

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State Highway Departments Surface 28,913 Miles in '36

State highway departments placed 28,913 miles of new highway surfacing in 1936, according to reports of state highway departments to the U. S. Bureau of Public Roads. The new surfaces consisted of 4,706 miles of high-type surfaces such as bituminous macadam, bituminous concrete, portland cement concrete, and brick and 24,207 miles of lower types of surfacing.

Subdivided according to class of road, 23,885 miles of rural primary state roads were surfaced, 614 miles of urban extensions of state systems, and surfaces were placed on 4,414 miles of secondary road under state control in the 14 states having state administration of local roads.

For every mile of surfacing placed on an earth road two miles of new surfacing was placed on old surfaced roads. A large part of the resurfacing consisted of replacement of worn surfaces with higher types.

The designated rural primary state systems now include 340,160 miles. The year's work brought the surfaced portion to 289,103 miles or 85 percent, comprised of 113,695 miles of high-type surfaces and 175,408 miles of low types. Those states having the largest mileage of high-type surfaced roads in the primary system are as follows:

New York	10,384
Illinois	10,126
Ohio	6,970
Pennsylvania	6,851
Texas	6,365

At the end of 1936 the existing surfaces on rural primary state roads were as follows:

	Miles
Brick and other block types	2,898
Portland cement concrete	81,283
Bituminous concrete and sheet asphalt	15,100
Bituminous macadam	14,232
Low-cost bituminous mix	33,805
Waterbound macadam	20,281
Gravel and similar surfaces	103,958
Sand-clay, topsoil, etc.	17,364
Timber bridge floors	182
Total	289,103

Bituminous treatments have been applied to 17,743 miles of waterbound macadam, 39,177 miles of gravel and 8,918 miles of sand-clay and topsoil.

The condition of improvement of rural primary State highways at the end of 1936 and the surfacing placed on these highways during the year in each state is shown in Table I.

TABLE I

State	Mileage in rural primary State system	Surfacing built during year	High-type surfaces existing at end of year	Low-type surfaces existing at end of year
Alabama	6,256	679	1,217	2,928
Arizona	3,459	294	235	2,402
Arkansas	8,996	257	1,738	6,458
California	12,554	1,060	5,558	6,280
Colorado	3,523	759	461	2,694
Connecticut	2,546	113	1,167	1,288
Delaware	1,702	78	1,257	445
Florida	11,935	177	1,173	6,105
Georgia	9,792	804	2,496	3,246
Idaho	4,758	470	192	3,290
Illinois	10,327	138	10,126	12
Indiana	9,355	710	4,662	4,174
Iowa	8,318	480	4,546	3,600
Kansas	9,095	2,993	1,549	5,337
Kentucky	8,720	475	1,742	6,096
Louisiana	4,448	273	2,243	2,158
Maine	2,519	86	664	1,774
Maryland	3,929	79	2,111	1,818
Massachusetts	1,720	31	1,567	153
Michigan	8,485	282	3,623	4,186
Minnesota	10,934	1,055	2,675	7,784
Mississippi	3,929	241	767	2,973
Missouri	8,167	423	3,880	4,159
Montana	5,111	969	86	4,171
Nebraska	10,534	725	950	6,190
Nevada	2,730	354	49	2,364
New Hampshire	1,427	35	440	987
New Jersey	1,379	37	1,291	41
New Mexico	12,114	630	120	3,638
New York	13,907	323	10,384	2,181
North Carolina	10,875	442	3,909	6,215
North Dakota	7,337	307	44	6,236
Ohio	14,593	258	6,970	7,428
Oklahoma	8,234	1,314	2,884	3,829
Oregon	4,618	464	1,635	2,492
Pennsylvania	12,982	420	6,851	5,297
Rhode Island	1,035	24	483	211
South Carolina	6,411	193	2,387	3,356
South Dakota	5,966	966	244	4,935
Tennessee	7,181	192	2,787	3,989
Texas	20,953	1,629	6,365	9,470
Utah	4,667	315	336	2,463
Vermont	1,765	78	438	1,309
Virginia	9,225	289	1,510	6,721
Washington	3,528	466	1,277	2,052
West Virginia	4,666	392	2,241	1,938
Wisconsin	9,888	940	4,330	5,499
Wyoming	3,567	166	35	3,036
Total	340,160	23,885	113,695	175,408

▼

Recent Sales and Production of Portland Cement

The Bureau of Mines, United States Department of the Interior reports that the portland cement industry in June, 1937, produced 11,163,000 barrels, shipped 12,649,000 barrels from the mills, and had in stock at the end of the month 24,015,000 barrels. Production of portland cement in June, 1937 showed a decrease of 1.9 percent and shipments an increase of 1.0 percent compared with June, 1936. Portland cement stocks at mills were 24.6 percent higher than a year ago. The total production for the first half of 1937 amounts to 54,008,000 barrels, compared with 43,529,000 barrels in the same period of 1936, and the total shipments for the first half of 1937 amount to 52,535,000 barrels, compared with 47,223,000 barrels in the same period of 1936. The statistics here given are compiled from reports for June, received by the Bureau of Mines from all manufacturing plants.

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PC7-7

COTTON-REINFORCED SURFACES

A Statement from The Cotton Textile Institute Regarding the Extent of Present Use, Behavior Under Traffic, Methods of Construction, and Pending Projects

SOME 600 miles of cotton fabric reenforced bituminous surfaced highways will be in service in more than a score of states by the end of the current year according to the Cotton Textile Institute. Approximately 500 miles of cotton roads, utilizing fabric supplied by the Federal government in the nationwide demonstration of the practicability of cotton as a road-building material, were completed during 1936. Reports to the Institute show that projects totaling approximately 100 miles, and for which reenforcing fabric was not available soon enough last fall, are now under construction or will be within the next few weeks.

In every case the performance of cotton roads—usually reenforced sections spaced between ordinary unreenforced bituminous surfaced sections—has compared most favorably with that of the adjacent unreenforced road as is evidenced in the following excerpts from the reports of various state highway officials:

John B. Church, Asst. Supt. of Maintenance, Maine State Highway Commission—"I am pleased to report that the cotton fabric reenforced bituminous surface appears to be in very good condition. Only a few pot holes developed during the winter. The surface of the adjoining section of bituminous treatment without cotton fabrics has developed a few more small pot holes than in the reenforced section."

G. S. Covert, Asst. Construction Engineer, Mississippi State Highway Department—"The cotton reenforced bituminous surface at Scott constructed in 1935, is showing no signs of failure. After an extremely rainy winter this project has proved very satisfactory and has necessitated little or no maintenance expense."

David Noonan, Asst. Commissioner of Highways, New York State Department of Public Works—"The following report by a local engineer in charge of Schenectady County—'The result of the experiment in reenforcing with cotton fabric membrane bituminous treatment is at the present writing apparently satisfactory. In many instances where cotton cloth was used, even though the roadway was heaved, sub-grade did not force itself through this protective covering. While several breaks have occurred throughout this highway this spring, its present condition represents a vast improvement over that which prevailed previously to this heavy surface treatment!' "

John V. Keily, Chief, Division of Roads and Bridges, R.I. State Department of Public Works—"Results from the use of cotton membrane as a stabilizing aid in surface treatment of sandy shoulders have proven satisfactory to date in preserving the shoulders and in preventing the edges of the gravel pavement from raveling. Its use as a stabilizing aid on shoulders seems worth while."

W. K. Beckham, State Highway Engineer, S.C. State Highway Department—"During the present season we expect to use cotton fabric membrane as reenforcement on approximately 40 miles of road. Nine miles are to be on new construction and approximately four miles on timber bridge floors. The remaining mileage will be retreatment."

Elsewhere, notably in New Jersey, cotton road construction is being undertaken on an increasing scale. It is expected that W. H. Baker, Township Engineer for South Brunswick Township, in New Jersey, will apply to the State Highway Commission for an appropriation sufficient to provide cotton fabric for the reenforcement of bituminous surfacing scheduled in Middlesex County this Fall. The new project will be built near the Stultz Lane at Cranbury, N.J., the first cotton road built in the state and which, after three years of service is in perfect condition, according to engineers, without having needed any maintenance.

Early in August, the construction of a 1½ mile stretch of cotton road at Perkintown in Salem County, New Jersey, attracted considerable attention among road builders. Interest centered in the use of cotton fabric and slow curing oil. When the fabric, 82 in. wide, had been placed over the road base, the oil, of 55 per cent asphalt content, was applied directly and bank-sand was spread over the oil. As traffic moves over the road in summer temperatures, the oil and sand mix and finally set up a road mat of only about ¼ in. in thickness.

A similar demonstration of the use of cotton fabric and slow curing oil, also a 1½ mile project, is scheduled for this month on the Deerfield Road, Upper Deerfield Township in Cumberland County, New Jersey. Another 4 miles of cotton reenforced road, utilizing tar with a crushed stone covering was completed on the Glassboro-Cross Keys road in Gloucester County in the same state.

On the Gloucester-Cross Keys road, rebuilt in 1934 and re-treated twice since, the existing bituminous surfacing was swept thoroughly by a mechanical sweeper. Immediately thereafter the cotton fabric was unrolled into place on the dry surface. The first strip was placed in the center of the road for approximately 1/3 mile and other strips, overlapping and making an aggregate width of 18 ft., 4 in., were applied on either side of the center.

The fabric was unrolled from a spool suspended from the rear of a county highway truck. When the third strip had been placed, a distributor truck applied directly to the fabric approximately 0.45 gallons of tar (Type U) with no difficulty and with no wrinkling or bunching of the fabric. The quantity of tar was adequate with enough remaining on the surface to hold firmly in place the stone screenings which were applied from mechanical spreaders at the rate of about 35 pounds of screenings per sq. yd. When the screenings had been rolled several times the road was ready for service.

One of the longest cotton roads in the country, a 14 mile highway between Faison and Clinton, North Carolina, was thrown open to traffic in August, with an intercommunity celebration in which Governor Hoey and other high officials, participated, dedicating the new road.

▼

A.R.B.A. Road Show To Be Held in Cleveland—The 36th Annual Road Show and Convention of the American Road Builders' Association will be held Jan. 17-21, 1938, at Cleveland, O.

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The New Period and Highway Planning Surveys

By DR. L. I. HEWES

Deputy Chief Engineer,
U. S. Bureau of Public Roads

UP TO the end of the first century of our nation's life, roads were a local item. They were seemingly natural phenomena that did not disturb us greatly. Much of their repair depended on the working out of the poll tax. About 1896, however, came a change. It was caused by the establishment of State Highway Commissions and by the application of State funds to highway improvement. There followed a period of twenty years of slow development of the principles of State highway construction and maintenance. This *preparatory* period enlisted the interest and actual operation of some thirty odd States. Twenty years later, in 1916, came another change caused by the first important Federal highway legislation.

$10,000,000,000 from Gas and Vehicle Taxes

We now, after 20 years of Federal Aid for highways, seem to approach the end of a first stage of real development. In those years the motor vehicles have increased from 3,500,000 to more than 28,000,000. The public revenue from registration of these vehicles has arisen from $26,000,000 to $360,000,000. Taxation of gasoline, begun by Oregon in 1919, has spread to all the States and has produced a constantly increasing revenue that last year (1936) totaled more than $691,000,000. The gasoline tax in Oregon was explicitly and exclusively for highways. It began so in other States, but there have been increasing diversions to other objectives.

It is important to realize, therefore, that the motorist, by gasoline and registration taxes, has paid in these 20 years $10,190,000,000. Except for the diversions this money went into the construction and upkeep of highways, especially the main highways. In this same period, the total Federal money for highways amounted to $2,683,363,000. Much of this Federal money came from the motor vehicle user as excise taxes and gasoline taxes. Up to 1933 such Federal taxes actually equalled the total government contribution. In other words, the motorist through the mechanics of a tax has built himself, in these last twenty years, the present system of modern highways. He has, as it were, accomplished a great cooperative undertaking, and through State and Federal legislation and administration.

It is to be observed here that the percentage of taxation on gasoline is almost without precedent. With an average tax of 3.4c per gallon in 1936, the motorist is paying perhaps 25 percent tax on his gasoline. With the exception of liquor and tobacco taxes this is an unprecedented tax. Any movement that tends to divert the proceeds away from roadbuilding will, by the same token, eventually compel hard resistance. Today the motorist's tax still brings him amazing returns. In a State like California, the average motorist who pays, say, $20, gets the advantage of $40,000,000 worth of new construction and maintenance, at least in theory, for his own personal use.

New Period of Highway Transport

But toward the end of this period from 1916 to 1936. there have arisen new problems, new pressures, and new objectives. Originally the system of roads designated exclusively to receive Federal Aid by the Federal Highway Act of 1921 was seven percent of our presumed total of 3,000,000 miles. With the accelerated Federal expenditures since 1933 for the relief of unemployment, and with the continuous improvement by the States with their own unmatched motor revenues, the Federal Aid System has had some form of improvement on most of its 220,000 miles. What next?

Several States have decided to place all their roads under State administration. Virginia and North Carolina are examples. Other States have placed an increased mileage under State jurisdiction—Pennsylvania is an example. There have not been provided corresponding increased revenues. The costs of the development of the greater mileages must therefore be subtracted from the funds formerly applied to the main highways on the State or Federal system. Federal funds also have been made available for secondary or feeder roads.

We see thus quite clearly that a new or second period of highway transport is at hand. There is to be a modified program.

In 1916 when the real development of the main roads or through systems began, there was not much argument as to what projects should be improved first—all were important and greatly benefited the public. Many of the roads were inter-State roads, or, in effect, National roads, and construction was so sound economically and so necessary from an operating standpoint that the investment of public funds could not seriously be questioned. Thus in the eleven Western States from a negligible mileage of important through roads, already improved in 1916, there has developed a system of dustless Federal Aid roads that now total about 29,000 miles. These roads incidentally enable inter-State traffic throughout the West in almost any direction without discomfort or dust, and at varying speeds up to, say, a maximum of 50 miles per hour.

Three Important Considerations

The selection of a system of adjoined roads or of a secondary or feeder road system is considerably more difficult. There is a large mileage pressing for improvement. Which are the next most important routes?

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Simultaneously with the movement for new mileage arises the very important demand for reconstruction of many miles of the main system. Many of the roads first improved in the past period are no longer adapted to modern requirements.

The question of greater safety means improved alignment and grade and width, and smoother surface and better combination of curvature and grade on many miles on these older improved highways. It means also wider rights of way, greater widths between culvert headwalls, setting back of utility poles, less guard rail and less dangerous ditches, and many other items that go to make safe, fast, comfortable highways. This indicated revamping of the older designs is going to be more costly per mile in most instances than was the original construction, and it is necessary.

The gradual realization of the disparity between older alignment and grades and widths and the modern traffic movement thus also has brought about the recognition of a new phase or period of highway construction and operation. We see now that this demand for reconstructed and better developed main routes comes simultaneously with growing and insistent demand for an extension of the improved road system.

A third important new consideration is the insistence by the cities on a larger share of the motor revenues for street improvement. The cities obviously are, in many instances, unable to take full advantage of the new motor transportation. Their streets were not designed for the motor vehicle, and they are too narrow for the combination of parked cars and the proper flow of traffic. Full advantage of the motor vehicle thus cannot be realized in metropolitan areas without improved means of ingress and egress. The concentrated populations cannot move freely to outlying residential areas. Mr. T. H. MacDonald, Chief of the Bureau of Public Roads, has voiced the need for a metropolitan highway system for "exploding" concentrated populations to wider areas. He has pointed out the advantages of belt line highways around such densely populated areas. The possible development of wide boulevards with separated traffic is increasingly obvious. The cost of such improvements is very great, but the advantages are large. Witness, for example, the traffic movement over the two great new bridges in the San Francisco area.

In the past it has been observed that rural development has followed a pattern determined by the presence of the railroads. This pattern is being broken up by the improvement of highways. The addition of secondary highways will modify this old pattern still further—undoubtedly to the advantage of the rural population.

Confronted thus with the demand for the reconstruction of the old main highways, the demand for extensions to adjoined secondary roads, and the demand of the cities for improvements which are manifestly pressing, it is clear that highway development and operation are entering a second distinct period.

Highway Fact Finding Survey

For this new period there must be intelligent advance planning. What, for example, is a proper distribution of the operating revenues to the various indicated purposes? What must be the order in which the objectives are attacked? These and other future activities must be programmed on adequate data obtained by sufficient measurements. Accordingly, the Bureau of Public Roads, beginning in 1935, has enlisted the cooperation of 44 States in a State-wide, nation-wide fact-finding study or survey. For such work Federal funds are available up to 1½ percent of the road appropriation, with suitable State cooperation.

This fact-finding survey, that will cost several million dollars, has been going on for over a year. It will produce data from which there should be derived positive and sound conclusions. The interest and even enthusiasm of most of the States in carrying on this planning work has developed increasingly.

There are three main lines of study. First is the inventory of all the roads in each State. This inventory will determine not only the State mileage accurately and in many cases for the first time, but the physical condition of this mileage and its administrative classification. Included in the physical condition will be the critical values of grade and curvature in the light of modern traffic. The road inventory will result in a map showing the position of the roads with respect to many important factors of culture. For example, railroads, grade crossings, population centers, ferries, etc.

The second important line of investigation concerns highway traffic. It is expected to have a competent measure of the traffic on all roads determined partly by an intermittent blanket count, and supplemented by the data from a State-wide system of key traffic stations at which traffic counts are more continuous. Supplementing the traffic count will be auxiliary investigations of the origin and destination of traffic; urban and rural highway use by bus and truck lines and the study of potential traffic peaks and congestion.

The third broad line of investigation concerns the financing of highways in the past, present and future. This finance study in some States will involve much difficulty in the running down of obscure expenditures for highways. It will involve the completion of a record of the incidence of taxation and the application of tax funds for highways. It should produce a more or less complete financial history of roadbuilding in the several States and the present trends and practices with respect to road finance.

Facts Brought by the Road Inventory—

In many States the road inventory already is practically complete. It has cost approximately 86 cents a mile. About 29 miles of field work on the average has been done daily. From this inventory record and other data the road maps are being built and when finally completed they will be perhaps the most comprehensive maps of the United States that have been produced. They will, for instance, show all objects that cause or influence traffic, such as villages, schools, public buildings, and highway connections with other transportation facilities.

Many interesting facts already have developed from the inventory. It appears that the exact total highway mileage in this country was unknown, and that many roads were incorrectly mapped. In some cases they were placed in the wrong county. There are many miles of so-called public road that are mere primitive trails. There are miles of road on which public funds have been ex-

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pended without authority. There are roads that have long been used with no record of their establishment.

In a large number of States, traffic records for the first time will be made available, on which to predicate future establishment, location and design of highways. The problems that have been more or less obscured by such general terms as trunk lines, State systems, or main highways will be given more precise definitions.

Of course, it is realized that many categories of highways will be relative to the conditions within the individual State boundaries. For example, roads in New York carrying 500 vehicles per day doubtless form a very common and prevailing class. In the State of New Mexico such a road would be important and in a much higher relative class than in New York. But whereas in New York two towns of 15,000 inhabitants each may be separated by less than 30 miles, two such towns in a State like Arizona or Montana may be separated by 150 miles and yet the necessity for inter-town traffic may be equal in both States.

We have known roughly that, previously, roads financed with State and Federal funds range from about 5 to 40 percent of the State total mileages and carry from 50 to 70 percent of rural traffic. But there remain about 2,700,000 miles of roads inferior in traffic importance, largely of local service, and with varying degrees of improvement. These roads may serve 40 percent of the total rural vehicle mileage. Some of them compare in importance with roads on the main systems. Thousands of miles, however, have traffic so low that it can be counted on the fingers. To what extent motor revenue should be allocated to the improvement of these less important roads is a fundamental question that the survey can help answer.

In connection with the financing of highways, very interesting things will appear. For example, evidence already is accumulated that motor user funds redistributed to counties, supposedly for highway use, have not so been used, but rather have they been indiscriminately pooled with other funds and buried for general purposes or even devoted to specific non-highway payments. Such diversions emphasize any complaint of the highway user that he is taxed at an unjust rate in comparison with other citizens, and they indicate the grave danger of the collapse of highway maintenance and construction.

Road Mortality Tables To Be Set Up

We need to know the costs of highways and to understand the service that the motor tax funds should purchase. To this end, mortality tables for various types of highway services are to be set up from the records and field observation. These tables will enable us to see much more clearly what to expect from our road money.

There finally will result for each State a traffic classification diagram. This diagram will show the total number of miles of road that carry any given total number of vehicles per day. From it can be determined then what percentage of the total vehicle movement can be served by any selected percentage of the State's total road mileage. This is a most important result from the traffic counts, the road inventory, and the maps. Not only will it be possible to determine the total number of miles to carry a given percentage of total traffic but the distribution of that traffic can be determined from the maps. The argument as to the relative traffic importance of roads will thus be ended.

In the past, emphasis has been on the main highways. Local property taxes have been applied largely to the local roads. Recently there has been a widespread abandonment of the effort to raise such local property taxes. There has been also an attendant and surprising tendency to divert motor revenues to objectives other than road improvement. To a considerable measure this tendency has been checked by the proviso of the Hayden-Cartwright Act of 1934, but already diversions and other causes had imperiled the continuance of essential highway operations. Yet we must all admit that the first obligation against highway revenues must be the maintenance and future improvement of our highways. Such expenditures must include even better appearance and surely increased safety. Beyond these obligations there must be provision for extension of service for which we now seek an objective measure. We must determine, in short, what system of various classes of highways we need and what it is going to cost to own and operate that system and who is to pay.

What the Highway Planning Survey Will Show

By the present highway planning survey, within another year we should know the position, length, condition, and administrative class of all our roads and have them plotted correspondingly in an atlas. We should know with respect to traffic, its density or presumable average daily number of vehicles on every mile of road, and the total annual movement and all derived data, such as distribution on the road system and the origin and destination (rural or city) and the general traffic circulation. With respect to finances, we should be able to determine more precisely the amount of diversion of traffic revenue to other than road purposes. We should be able to observe the total results of so-called local or county expenditures that for many years has totaled $500,000,000 annually. We should be able to analyze the distribution of the motor revenues to the respective classes of traffic service.

These highway planning surveys are typical of the engineer's methods of procedure. He deals necessarily with patiently acquired facts. It is difficult for him to escape the limits of the mathematical constants of his trade. In this highway planning survey, however, he is seriously studying on a nation-wide scale also what may be termed the "social accounting" of his product. He is setting up a long range view over the years. He is attempting to fill in gaps in his knowledge and to take a step ahead in the art of road engineering. He is attempting, by the accumulation of scientific principles, to get a better viewpoint of what he is facing in this next broad step. By looking over his patiently accumulated experience in the past, he hopes, in the light of the new found data, to guard against future error. By this great planning survey, the engineer and the public official should acquire, as never before, the art of arrangement of the road pattern, the determination of its quality in reference to its traffic duty, and its revenue. And thus, finally, to set up a properly financed road system as a comprehensive operating unit with proper relations of all its parts.

Acknowledgment—The foregoing is an abstract on a paper presented June 15 at the Ninth Annual Session of the Institute of Government, School of Government, The University of Southern California, Los Angeles, Calif.

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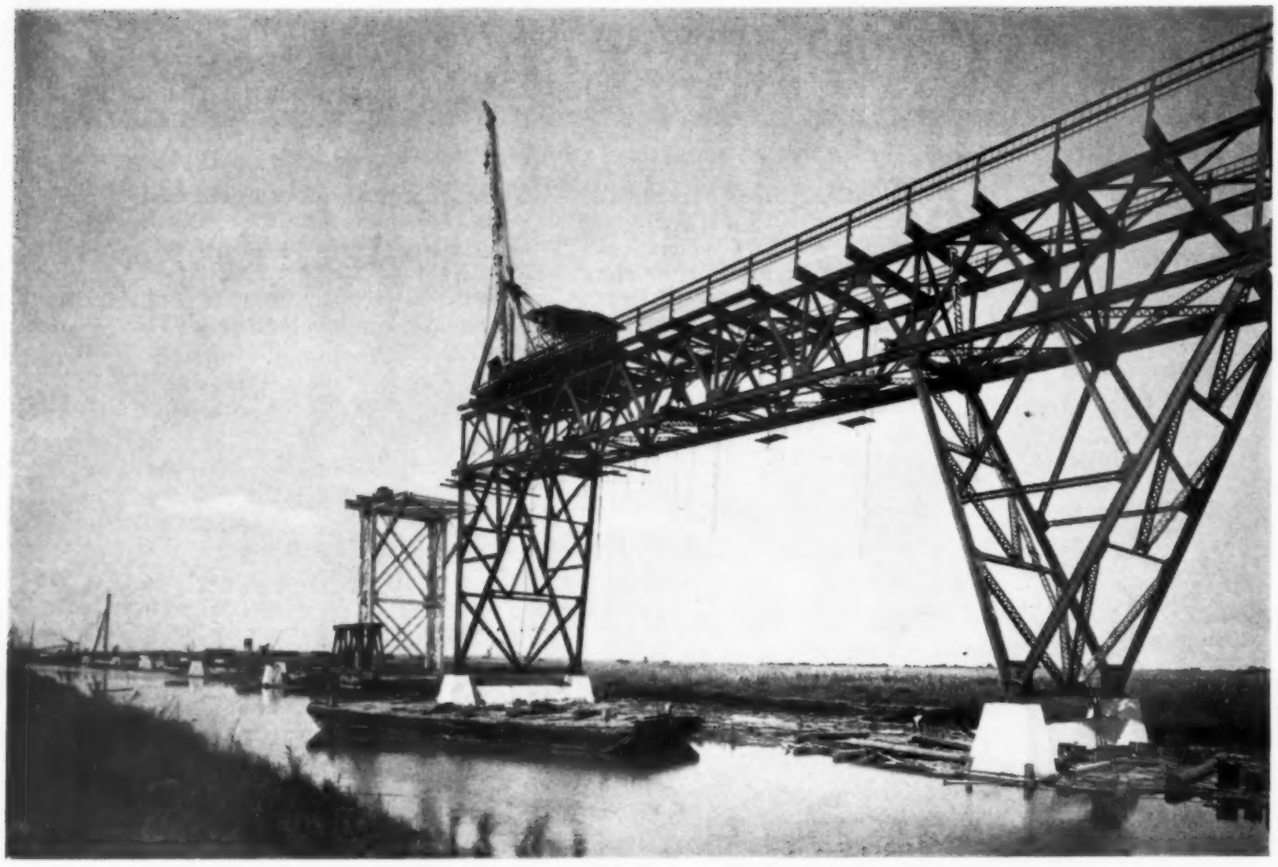

Construction View of South Approach to Neches River Bridge at Port Arthur, Tex.

The Neches River Bridge

Good progress is being made in the construction of the Neches River bridge at Port Arthur, Tex. The illustration shows the erection of the steel on the south approach.

About 1,220 ft. of the superstructure on the south approach has been erected by the Taylor-Fichter Steel Construction Co., contractors, and the approach has still 1,900 ft. to go before reaching the main river span.

This view shows the south approach, looking toward the river. The span shown is supported by V-shaped tower bents. These bents are designed as integral parts of the truss span. The falsework tower for the next span, No. 30, is shown in the left foreground. At the extreme left is shown the derrick of a pile driver of the Spence-Howe Construction Co. of Port Arthur, engaged in driving falsework piling for a 300-ft. span.

In the foreground is shown a construction canal dredged along the length of the structure for the transportation of equipment and material on barges.

The bridge will cost $2,750,000 and will be the tallest highway bridge in the South. Due for completion in March, 1938, the bridge at Port Arthur will be 7,815 ft. in length. The main span will provide a horizontal clearance of 600 ft. and a vertical clearance above water of 176 ft. These liberal clearances were necessary to provide for navigation of ocean-going vessels on the Neches river.

▼

Illinois County Asks State To Halt Diversion of Road Funds.—A resolution asking the Illinois legislature to submit a constitutional amendment against diversion of highway funds has been adopted by the Sangamon county board of supervisors.

Bibliography of Highway Lighting

A bibliography on highway lighting covering primarily the years 1913 to 1936, with accent on the more recent developments, has just been published by the U.S. Department of Agriculture. The references are arranged according to the time of publication under each of these years, with a collective author index at the end. Articles in French, German, Spanish, and in other languages, as well as in English are listed.

This annotated bibliography, prepared by the Bureau of Public Roads, may be obtained free from the U.S. Department of Agriculture, Washington, D.C. It is Miscellaneous Publication No. 279.

Highway engineers and city officials will find this bibliography a guide to literature on the latest developments in lighting streets and highways, bridges, viaducts, tunnels, and causeways. For instance, material is available on new types of lamps, and on the photo-electric cell which switches the system on and off, depending upon the natural light available, as well as on the French system of equalizing tunnel illumination with the outer light at all times.

In preparing the bibliography these lists were consulted: Industrial Arts Index for 1913-36; Engineering Index 1892-1935; and Public Affairs Information Service 1915-36. The bibliography includes references to books, periodicals, and publications of societies through 1936. There has been an attempt to group together references to the original publication and subsequent reprints, abstracts or discussions of it.

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EDITORIAL

Diversion—A Bad Roads Tax

AND still it continues. Figures recently compiled by the U. S. Bureau of Public Roads show that nearly 16 cents out of every dollar of state taxes paid by highway users in 1936 were allotted to non-highway use. When will this unfair practice stop? Of the state taxes on highway users employed for other than highway purposes, about $89,000,000 went to the general funds of state, county and municipality; $36,500,000 was paid out for relief unemployment; $33,000,000 was given to education; and approximately $11,000,000 went for such miscellaneous purposes as airports, navigation, debt service of non-highway obligations, irrigation, parks and other purposes.

When the gas tax was levied upon the motoring public it was justified on the grounds that the money was to be used for the construction and maintenance of good roads over which their vehicles must travel. This argument is well recognized by all in the construction industry. We don't need to tell ourselves this any more. What we do need, though, is for each one of us to quote these figures and the arguments to the editors of our local papers. That is the only justification we have for printing these data here.

Elsewhere in this issue you will find a table of motor vehicle revenues allocated by each state for state highway purposes, for local roads and streets, and for non-highway purposes. Send this to your local newspaper. In your letter explain why diversion should be stopped. Diversion breaks faith with the motorist and the gas tax becomes just another sales tax. Modern highway requirements demand a fixed income.

Emergency diversions of this income throw the system into confusion, waste and delay. The result is a system of bad roads. We need not set down at this time an analysis of the bad roads tax. Suffice it to say that it strikes the individual motorist's pocketbook many fold harder in motor vehicle repairs, than does the tax on gasoline used in driving on good roads. There is a real, menacing bad roads tax. Stop diversion and help curb the exorbitant bad roads tax.

▼

Pacifism and Road Building

IN defining Pacifism Webster gives, "Opposition to war or to the use of military force for any purpose." "What's that got to do with roadbuilding?" you ask. Simply this—Why oppose human nature? Until human nature can be revamped it is impossible to stop war. Likewise, until human nature can be revamped it is impossible to stop men, generally, from procrastinating when the boss is the public. It is an impossibility to put into the public employee the same vital interest, initiative and efficiency that exists on public construction where private industry is charged with the responsibility and the hazard of profit or loss, as is the case under the contract system. In other words to be blunt about it, so far as economy is concerned, the day-labor system for public construction work is inferior to the contract system because of the shortcomings of human nature. Until human nature is changed there can be no real argument in favor of the day-labor system. So why oppose human nature? The line of least resistance is to capitalize on human shortcomings. At the same time, by such capitalization, greater economy results.

After all, you see there is a parallel between pacifism and roadbuilding.

Ever since Adam and Eve, war has constantly recurred. It is founded upon the basic characteristics of the human race. The nations of the world which have survived have been those which were prepared for war; they did not attempt to oppose human nature. They never "played ostrich." The efficient public works construction executives likewise prepare for economic administration of public funds. In preparing to capitalize on human shortcomings they employ the contract system.

A few years ago the United States Chamber of Commerce condemned the day-labor method of construction after an extended and comprehensive study of the subject. This report considers the common argument put up to support day-labor, i. e., "That it saves the contractor's profit." This trite fallacy is exploded in the report as it continues, "This theory is fallacious, and obviously so. Experience, skill and trained organization of the contractor will enable him to earn a profit in competition with the day-labor system."

▼

All-Fill Grading

FROM Arizona comes a suggestion for a method of road building that has a great deal of merit. One of the district engineers for the state highway department prefers to build a road without disturbing existing topography or marring the landscape by cuts. He would build the road on top of the existing topography.

To get a continuous uniform grade line would require hauling suitable fill material to those places where fills would be required. As a general policy, in the abstract, this plan is meritorious. The landscape is not scarred by open cuts. It has the advantage that culverts could be placed high in fills and water ponded on the lands where it falls, thus helping to conserve rainfall. Natural drainage courses would not be altered, thus preventing erosion of roadside ditches. This latter is a serious problem in many places.

Fill material pits could be selected in places unviewable from the road thus maintaining the natural roadside beauty of the area. Central excavating plants could be erected, in those pits, so designed as to load out only selected suitable fill material. What the economics of this method might be is not known to the writer. However, with present day large, speedy hauling units it is possible that costs of construction might be no greater than by following out present cut-and-fill method of highway grading. A road so graded would have the advantage of less settlement than if done by the cut-and-fill method.

Certain it is that topography existing in places where a road is to be relocated was established to that contour by thousands of years of wind and weather. Only too well does the highway engineer know the penalty for disturbing that topography. Road ditch weirs, side culverts, spillways, flumes, and sewers attest to the engineer's efforts to control ditch erosion in cuts. All costs considered, all-fill road grading may be economical.

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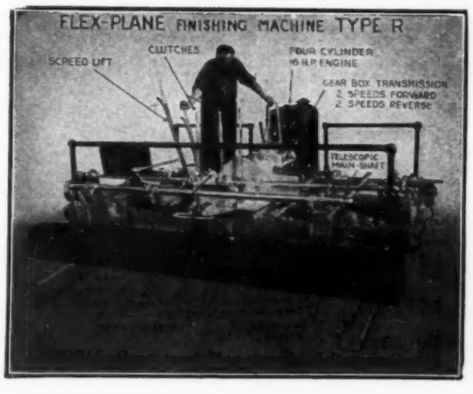
- Air Controls
- Rugged Frame
- Ample Power
- Roomy Cab
- 25 mph. Speed
- TruckEconomy

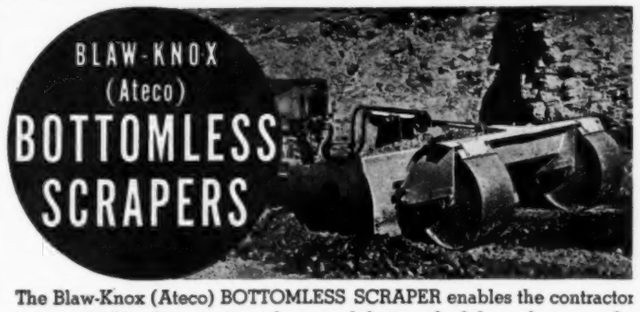
MICHIGAN POWER SHOVEL Co BENTON HARBOR, MICHIGAN, U.S.A.

"WHY IT'S BETTER"

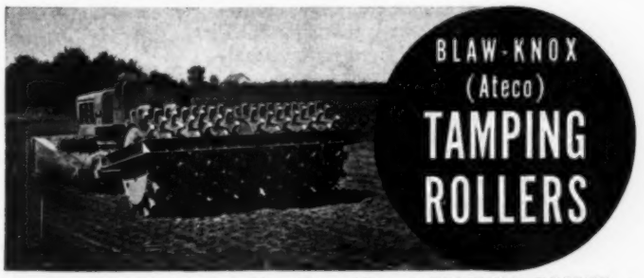

FLEX-PLANE FINISHING MACHINE TYPE R
SCREED LIFT
CLUTCHES
FOUR CYLINDER 45 H.P. ENGINE
GEAR BOX TRANSMISSION 2 SPEEDS FORWARD 2 SPEEDS REVERSE
TELESCOPIC MAIN SHAFT

The "FLEX-PLANE" Finishing Machine "sound in principle and construction"—a single wide screed, unnecessary screeding and agitation of concrete, perfect control, screeds backward as well as forward, universally used.

FLEXIBLE ROAD JOINT MACHINE CO.
WARREN, OHIO



The Blaw-Knox (Ateco) BOTTOMLESS SCRAPER enables the contractor to operate his dirt moving job on a definite schedule and at a profit. It keeps dirt moving costs down.



Tamp as you roll with a Blaw-Knox (Ateco) TAMPING ROLLER, a remarkably efficient and economical device for compacting heavy and light earth fills of every description. Meets requirements of all State and Government specifications.

Send for descriptive catalogs

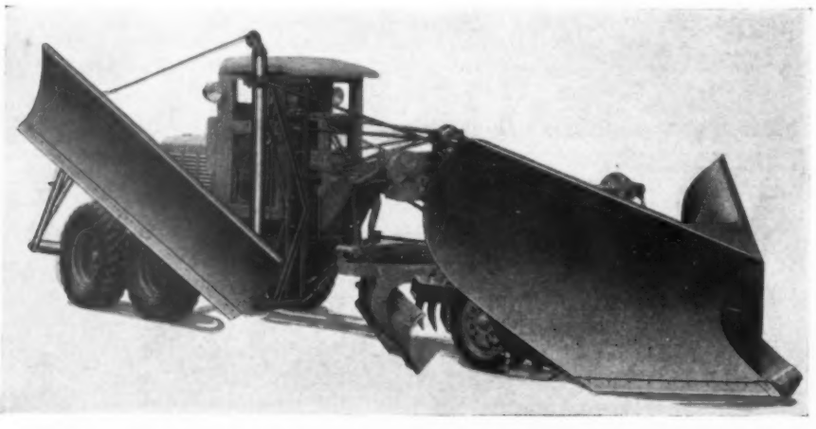
BLAW-KNOX COMPANY
2003 Farmers Bank Bldg, Pittsburgh, Pa.
Please send:—CATALOG No. 1540—Blaw-Knox (Ateco) BOTTOMLESS SCRAPERS . . . ☐
Please send:—CATALOG No. 1550—Blaw-Knox (Ateco) Sheepsfoot TAMPING ROLLERS ☐
Individual_____
Company_____
Street_____
City_____ State_____

NEW EQUIPMENT AND MATERIALS

New Adams Snow Plow and Wing

A new snow plow and a new snow wing have just been announced by J. D. Adams Company of Indianapolis, Indiana. These units are intended for use on Adams Motor Graders Nos. 301, 151, 50 and 51 which use engines of 39, 57, 59 and 62 H.P. respectively. They are shown here mounted on the No. 51 which is powered by 62 H.P. Diesel engine.

The snow plow is a new stream-line model which, the manufacturers claim, has been carefully designed to give the maximum throw of light snow at high speed and to move heavy snow with a minimum of power. The plow is 3 ft. 6 in. high in front and 6 ft. high at the rear. The curvature lifts the snow as much as 5 ft. before throwing it out which means that the snow is not simply pushed sidewise (as with a wedge action) but it is actually lifted up and thrown out over the top of the surrounding snow even though the snow is quite deep.



Adams Heavy Duty Grader Equipped with "V" Plow and Wing

The snow wing slopes the snow banks moving the snow outward; this simplifies widening operations with the plow, and finally leaves the snow banks so sloped that the moved snow is not apt to find its way back to the cleared roadway. The wing, which is 12 ft. long and flares from 31 to 36½ in. wide, is independently adjustable for height at both ends. It may be set horizontally to move light snows outward as much as 10 ft. or it may be angled at a height to deliver snow on top of a 10 ft. bank.

Both snow plow and snow wing are power-controlled, utilizing the regular power outlets at the standard power control box furnished with each grader. The snow plow may be purchased and used without the snow wing, but the wing should be used in conjunction with the plow.

Complete descriptive literature can be obtained by writing the manufacturer.

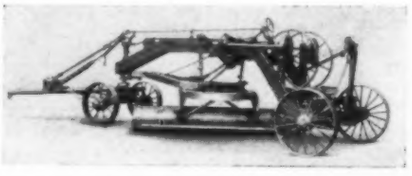
Hug Introduces New Model

A new Hug Lugger, Model 20, has been announced by The Hug Company, Highland, Illinois. This new truck, according to the manufacturer, embodies all the features of the well known Model 30 Hug Lugger on a smaller scale, with an 8 cubic yard body and an unusually high dumping angle hoist. Complete hoist control is had at all angles at all times. Electric arc welding throughout the entire chassis is another feature The Hug Company stresses for low maintenance cost, while the operating costs are held to the minimum by the Caterpillar Diesel engine.

The Model 20 Hug Lugger

New "Caterpillar" Blade Grader Announced

A new model No. 33 Blade Grader has been announced by Caterpillar Tractor Co. This machine, equipped with stand-



Model 33 Blade Grader

ard 8-foot blade weighs 5,900 pounds, and is similar in general design to the "Caterpillar" No. 44 and No. 66 Graders recently added to the line.

The machine offers unusual flexibility and rapidity of blade movement. The blade can be moved from a ditching to a high bank cutting position without offsetting the blade on the beams or making any changes in the supporting links. It is not necessary for the operator to leave his platform or stop the tractor.

The No. 33 Grader is best suited to the "Caterpillar" Diesel RD4 Tractor or other tractors of approximately 35 drawbar horsepower.

▼

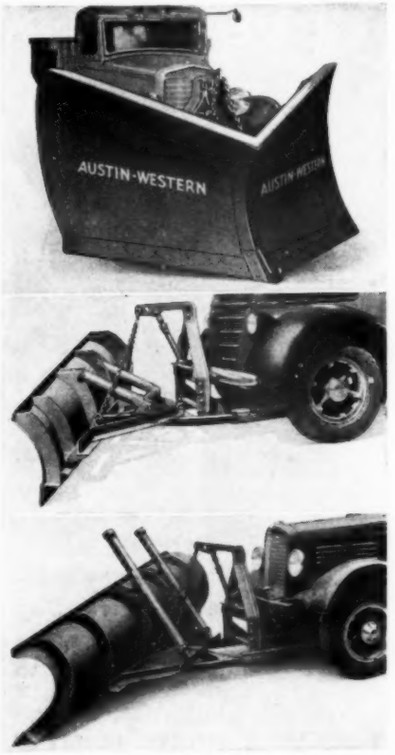
New Snow Plows for 1, 2 and 3-ton Trucks

A new and improved line of snow plows, built to match the power output of one, two and three-ton trucks, has been announced by the Austin-Western Road Machinery Co., Aurora, Ill.

According to the manufacturer, these plows have been carefully designed and fabricated to obtain better balance and greater strength, and they are curved to handle a maximum quantity of snow with a minimum expenditure of power. All excess weight has been avoided to aid truck operation and permit quick and easy attachment or detachment.

The full line comprises nine models of which there are three general types—see accompanying illustrations. These include the V-type, the taper-blade type and the straight-blade type. The various types, of a given size, are interchangeable on the same underframe.

Features available include rubber-tired caster wheels, cast iron runners, safety



Three Types of Austin-Western Snow Plows

Let's make medicine

the council fire is lit . . .

INTERESTING HOWS

HOW the Industrial Advertising Manager Can Function in His Public Relation Program.

HOW to Evaluate Publications—Methods of Qualitative and Quantitative Analysis

HOW to Use and Not to Use Industrial Motion Pictures

HOW to Develop and Maintain Industrial Mailing Lists

HOW to Secure Greater Effectiveness from the Advertising Dollar

HOW to Organize and Carry on Market Research Activities and How to Apply the Facts

HOW to Apply Showmanship and Add Sales Power to Industrial Copy

HOW to Write Better Letters and Use Them More Effectively

HOW! BROTHER

By smoke writing and carrier pigeon—by swift runner and heliograph, word has reached the council fire that the braves of many tribes are on the march and will assemble in full force at the big 15th Annual Pow-wow of the NIAA, September 22, 23, 24, at Chicago.

Important plans will be discussed—extensive exhibits of successful advertising and sales promotional material displayed and valuable "Hows" presented by industrial sales and advertising directors.

Of course, pleasure has had its full consideration—banquets, night clubs, bathing, golf—and bows and arrows for those who prefer.

Mr. H. D. Payne, Chairman, 2145 Walnut Street, Chicago, Ill., will gladly accept your reservation or send further information—write him.

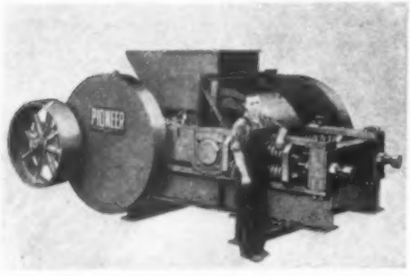
Prepared by The Buchen Company, Chicago

spring release and means to adjust the pitch and plowing angle of blades. New bulletins describing these plows have just been issued.

▼

A New Large-Size Roll Crusher

The Pioneer Gravel Equipment Mfg. Co., 1515 Central Ave., N.E., Minneapolis, Minn., announced in August a new



New Pioneer Roll Crusher

crusher with rolls each 54 in. in diameter and 24 in. wide. The machine is designed for commercial quarries and large plants generally. It includes manganese steel shells—positive adjustment—Star gear drive—Timken bearings—spring release—and enclosed gear drive.

▼

Littleford Announces New Model Distributor

The Littleford line of Pressure Distributors has been made more complete by a new model, called the "TS." It is a full-sized unit, built for heavy service along the lines of senior model conventional distributors, in sizes 500 to 2000 gallons inclusive for truck or trailer mounting, insulated or plain, and handles all types and grades of road bitumens for heavy construction work.

New Littleford Distributor

The heating system provides sufficient heat to raise temperature of a tankful of material 3 degrees F. per minute. Less than one-third of a tankful can be safely heated. Control of the pumping system is entirely governed by the patented Littleford Single Valve (same as Model "C"). Spray bars shift laterally and vertically. Any rate of application from 1/10 to 2 gallons per sq. yd., with spray for lengths up to 24 feet can be had.

Operator's platform is high enough to keep him out of the smoke and fog. He can see both sides of the road. A fuel pump on the engine provides the correct amount of kerosene to the burners.

Bulletin M-17 on this new distributor is available to anyone writing to Littleford Bros., 454 E. Pearl St., Cincinnati, Ohio.

▼

Ransome Makes 5-yard Mixer for Philadelphia Plant

One of the largest mixers ever installed in a central mixing plant has just been placed in operation by The Liberty Corporation of Philadelphia. It is a Ransome 5 cu. yd. mixer designed and built by the Ransome Concrete Machinery Co., Dunellen, N. J.

One of the outstanding features incorporated in this mixer is the pneumatically controlled discharge chute which is quickly, easily, and positively manipulated by a light twist of a small lever in the control room. The air is supplied by an Ingersoll-Rand Air Compressor.

General View of Liberty Corporation's Mixing Plant

The Liberty Corporation has a Ransome 3 cu. yard mixer in the same plant.

▼

Le Tourneau Announces 15-Yard Buggy

A new 15-yard, pneumatic-tired buggy, designed particularly for rock jobs, long hauls, hauling ore or gravel, or work on levee jobs where digging must be done by dragline or shovel, is announced by R. G. Le Tourneau, Inc., of Peoria, Illinois, and Stockton, California.

This new buggy, except for capacity, is very similar to the Le Tourneau 24- and 30-yard buggies. It uses the same positive dumping method that has proved so successful during the past four years in the operation of the larger buggies on such jobs as Boulder Dam, All-American Canal and Grand Coulee. The method is this: in unloading, the body moves backwards over the bed, pushing the load through an ever-widening opening to the rear, so the wheels do not travel over the material as it is unloading. Extended, this opening is 7 ft. 10 in. by 9t. 10 in.—large enough to make easy the unloading of boulders. Unloading takes less than a minute and can be accomplished either standing still or on the move, so the load can be spread, as desired.

The 15-yard buggy is built primarily for use with shovels and draglines working in material that is too hard for scraper loading. It maneuvers like a two-wheel cart, consequently, is easily spotted; its large body makes unnecessary the careful spotting of the shovel or dragline bucket. Four 18x24 pneumatic tires and Timken roller bearings make it a hauling unit of very light draft. The big tires keep it on top of soft going, and its light draft makes tandem operation practical if desired.

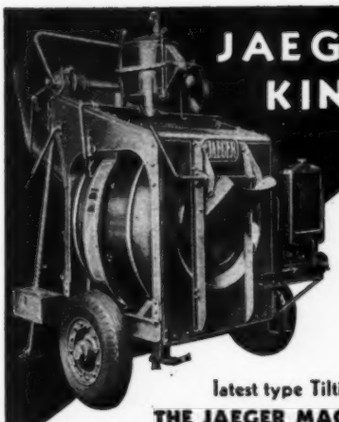
The New 15-Yard Buggy

Like all Le Tourneau equipment, the 15-yard buggy is built out of alloy steel, arc welded throughout. The bottom is wood-filled and stoutly reinforced for handling the most punishing of loads. It has a struck measure capacity of 11.84 cu. yds. and a heaped measured capacity of 15 cu. yds. Weight is approximately 14,500 lbs.

G&R PUMPS

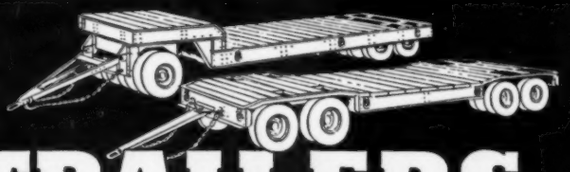
SAVE TIME and MONEY
with the pump that WILL NOT CLOG. Handles the dirtiest water without fuss or bother. Full volume pumping whenever there is water to move. Full range of sizes.
The pump you can DEPEND UPON all the time.
THE GORMAN-RUPP CO., - MANSFIELD, OHIO

JAEGER SPEED KING - 7S and 10S TRAILER MIXERS



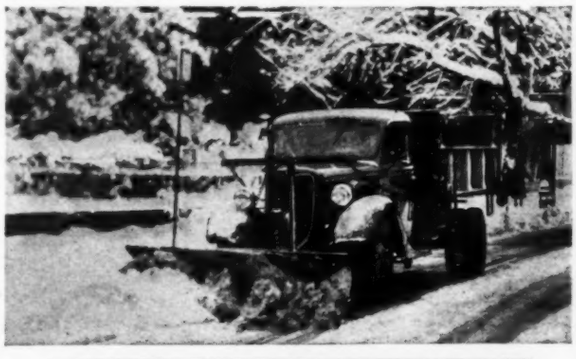
Trail at 35 m.p.h. on Timkens and pneumatic tires — 5 to 7 seconds loading, 7 second discharge of stickiest dry concrete. End discharge cuts placing costs, pours direct into forms. Get our prices, all sizes 3½S to 56S, latest type Tilting and Non-Tilt mixers.
THE JAEGER MACHINE COMPANY
223 Dublin Avenue Columbus, Ohio

LA CROSSE Heavy Duty TRAILERS



TWELVE different types . . . Five Tons to Two Hundred Tons capacity . . . Four to Sixteen Wheels . . . Two to Eight Axles . . . Designed to Avoid Highway Damage . . . Simplify your Heavy Hauling Problems . . . Write . . .
LA CROSSE TRAILER & EQUIPMENT CO., Funk Bldg., La Crosse, Wis., U. S. A.
SUBSIDIARY OF LA CROSSE BOILER COMPANY

THE LARGEST TRAILER IN THE WORLD IS A LA CROSSE !

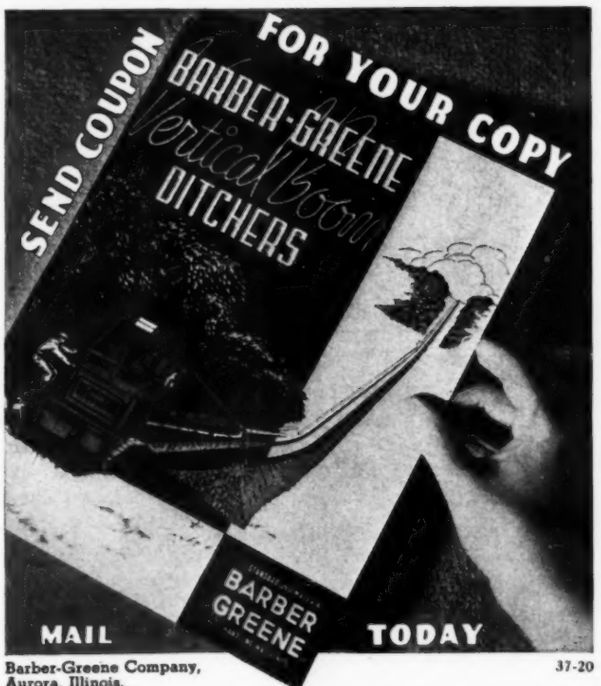


BAKER
SNOW PLOWS
FOR MOTOR TRUCKS AND TRACTORS

The 29-year-old Baker line offers a wide choice from 21 models of truck plows for heavy and light trucks as well as many models for large and small tractors. You can depend on a Baker.

Send for Snow Plow Catalogs

THE BAKER MANUFACTURING CO.
506 STANFORD AVE. SPRINGFIELD, ILL.



Barber-Greene Company, 37-20
Aurora, Illinois.
Gentlemen:
Please send me your new 36-page catalog which shows all five Barber-Greene ditchers, giving complete specifications and 14 pages of job photos. I understand this incurs no obligation.

Name .....
Company .....
Address .....
City ..... State ..... RS

WE

- We cut your costs and save time and money.

WE control equipment unobtainable elsewhere.

WE render unequalled service.

BREAK

- WE specialize on difficult jobs BREAKING & BLASTING.

WE have most modern equipment.

OUR trucks go anywhere.

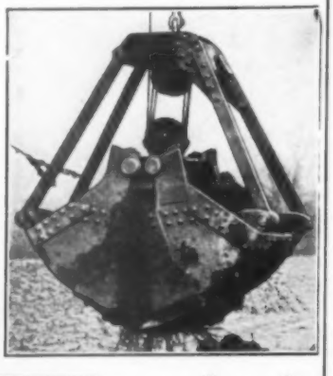
CONCRETE

- Trenches — Roads — Foundations Building Alterations — Railroad Work and Heavy Engine Foundations.

CONCRETE CUTTING CORP. OF AMERICA

52 Clark Street • Brooklyn, N. Y.

Mfrs. Rapid Pavement Breakers.



Bigger Payloads

WHEN YOU USE WILLIAMS BUCKETS

You can make more money with the Williams Multiple-Rope Bucket, shown above.

It has a DOUBLE HINGE, permitting longer spread of open bucket and a more rigid and powerful construction. WRITE FOR BULLETIN.

THE WELLMAN ENGINEERING CO.

7020 Central Avenue, CLEVELAND, OHIO

WILLIAMS POWER-ARM, POWER-WHEEL, MULTIPLE-ROPE, DRAGLINE ..... *buckets*

WITH THE MANUFACTURERS

Johns-Manville Announces Promotions to Form New Manufacturing Divisions

Seven promotions, including the election of three new vice presidents of the Johns-Manville Products Corporation, were announced on August first by Lewis H. Brown, president of Johns-Manville Corporation.

The new vice presidents of the J-M Products Corporation, a subsidiary controlling most of the Company's widespread manufacturing and mining activities, are A. R. Fisher, formerly manager of the Company's largest factory at Manville, N.J.; J. P. Kottcamp, who has been the manager of the key Mid-Western factory at Waukegan, Ill.; and Alexander Cromwell, currently manager of the Pacific Coast manufacturing operations.

These men have general supervision over newly-established manufacturing districts, each of which includes five factories. Mr. Fisher has been assigned the Eastern District.

The Central Division, consisting of plants at Waukegan, Ill.; Alexandria, Ind.; Richmond, Ind.; Newell, West Virginia; and Marrero, La. is under Mr. Kottcamp, whose headquarters remain at Waukegan.

Mr. Cromwell is in charge of manufacturing activities on the Pacific Coast at Lompoc, Pittsburg, Redwood City, Los Angeles and Watson, California.

J. E. Begert, formerly head of the Cost Reduction Department at J-M Headquarters in New York City, has succeeded Mr. Fisher as manager of the Manville plant.

At the Waukegan factory K. W. Huffine, formerly manager of the Alexandria plant, has been named to succeed Mr. Kottcamp as manager.

H. J. O'Brien, formerly superintendent of the Rock Wool Department at Manville factory, has become manager of the Alexandria plant.

Mr. W. Kelty, who was Assistant to Mr. Begert in the Cost Reduction Department, succeeds him as manager of that department.

Coincident with the establishment of these three new manufacturing districts, Johns-Manville has consolidated its mining operations at Asbestos, Province of Quebec, and Chrysotile, Arizona, to form the Asbestos Division, which is under the charge of C. H. Shoemaker, vice president of Canadian Johns-Manville Company, Ltd.

▼

C. F. Pease Company Moves to New Location

The C. F. Pease Company of Chicago, manufacturers of blue printing machinery, blue print paper, photographic lamps, and drafting room furniture, announce the removal of their plant and office to 2601 W. Irving Park Rd., telephone Independence 2800.

Confusion of Good Fellows

It does happen in the best regulated publishing families, so here we are with apologies for a mix-up in last month's issue. And yet we are not too apologetic, for the two involved are none other than H. C. Whitehurst, Director of Highways of the District of Columbia and Past President of American Road Builders' Association and Neil E. Jersey, recently chosen Vice President and General Manager of W. A. Riddell Corporation. Either might be in worse company.

The error consisted in our printing of Mr. Whitehurst's photograph in an announcement of Mr. Jersey's election to the new offices. Here they are—scarcely like twins but damn good fellows, both of 'em.

Neil E. Jersey

H. C. Whitehurst

Max Hofmann, Sales Manager for Waukesha Motors

Max Hofmann

Max Hofmann has just been appointed to the position of Export Sales Manager of the Waukesha Motor Company, succeeding M. E. Nicklin.

An engineer of experience, Mr. Hofmann joined the Waukesha Motor Company in 1926, coming from the Argentine branch of Korting Brothers, German Diesel engine building firm. His work there as a Diesel installation engineer, his subsequent journeys throughout Europe, Africa, and both Americas, and his ability to speak four languages fluently make him well qualified for his new position.

With Waukesha, Mr. Hofmann's first activity was in connection with their oil engine development. His thorough engineering schooling in Germany and his intimate practical knowledge of Diesels and other oil burning engines made him a valuable member of the engineering staff. He was in much demand as a speaker and presented numerous papers on Diesel engines, and related subjects before both the A.S.M.E. and the S.A.E., not a few of which have been published in engineering trade papers.

During the last few years, with export business becoming more and more important, Mr. Hofmann has devoted much of his time to Waukesha's activity in this field. His engineering training has been applied to foreign sales and installation problems, and he has made a number of visits to Latin America in this capacity.

▼

Ransome Appoints Five New Sales Representatives

Ransome Concrete Machinery Co., Dunellen, N. J., recently appointed new sales representatives as follows:

Pensacola, Fla.,
Manufacturers Supply Co.
711 Blount Bldg.

Shreveport, La.,
Meriwether Supply Corp.
1312 Jordan St.

Salt Lake City, Utah
Smoot Machinery Co.
46-50 West Fourth South St.

El Paso, Tex.
Mine & Smelter Supply Co.

St. John's, Newfoundland
Dominion Distributors Co.
Mitchell Bldg.—Water St.

MORE PATCHES PER DAY
with the same crew

Your men can put in more patches per day with a Littleford No. 84-HD Kettle and handspray attachment. No other kettle will heat as fast or heat as much material per day, safely, as this Littleford "Double Heat Circulation" kettle. That's why hundreds of these kettles go into service every year in all parts of the world. Write today for the latest prices on the kettle to suit your needs—50 to 300 gallon sizes.

Ask for New Bulletin M-I on Littleford Kettles

BLACK TOP ROAD MAINTENANCE EQUIPMENT
LB
SINCE - 1900
LITTLEFORD
LITTLEFORD BROS.
454 EAST PEARL STREET
CINCINNATI, OHIO

"Al" Hagele to Manage Tractor and Equipment Co.'s Springfield Branch

M. Leff, Office Manager and Asst. Treasurer of the Tractor & Equipment Co., Chicago, announces the appointment of "Al" Hagele as Office Manager of the company's new branch at Springfield, Ill.

▼

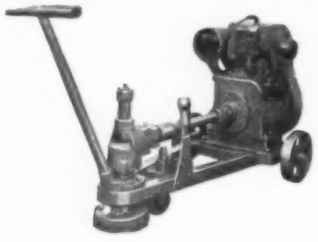
Bakewell Now Vice President Blaw-Knox

Donald C. Bakewell, who recently became affiliated with the Blaw-Knox Co., Pittsburgh, Pa., has been elected a vice president.

Republic Steel Has Four New Distributors

Four new distributors for Republic's tubular products have been announced by N. J. Clarke, Vice President in Charge of Sales of Republic Steel Corporation, Cleveland, O. They are: The Bluefield Supply Co., Bluefield, W. Va.; Ormand Plumbing Supply Co., San Antonio, Texas; J. Gaber Co., Houston, Texas and Morgan's Inc., Savannah, Ga. The complete range of tubular products, including Republic steel merchant pipe and Toncan Iron pipe, will be distributed by these well-known firms.

"BERG"
HIGHWAY SURFACERS



B-est for results.
E-conomical to use.
R-eliable in operation.
G-reat for simplicity.

The "Berg" is a simple, economical one-man machine for cutting down high spots and surface irregularities on concrete roads.

Available in two models—with Power Take-Off and External Magneto.

Circular on Request

THE CONCRETE SURFACING MACHINERY CO.
CINCINNATI, OHIO

Chain Belt Completes New Plant

Chain Belt Company of Milwaukee has just completed the erection of a new building at its West Milwaukee works to house an enlarged machine shop and the West Milwaukee offices. All machining operations, with the exception of those in connection with chain and sprocket wheels, are being moved from the Milwaukee works to the new building at West Milwaukee. Thus this department, which machines all the parts used in concrete mixers, speed prime pumps, Moto-Mixers and Pumpcretes, will be located close to the construction equipment plant, where all of these units are assembled.

In the new building there will also be located the spray nozzle shop and the idler shop for the production of REX-Stearns Belt Idlers. The belt idler operations, which were formerly located at Cleveland, were moved to the West Milwaukee works at the end of 1933.

The new building consists of five longitudinal bays and one large transverse bay. The outside dimensions are 152 feet x 292 feet. The exterior is finished in red brick with double tier steel casement windows and a saw tooth roof almost entirely of glass. The plant is located on a 52-acre tract and was designed by Eschweiler and Eschweiler, of Milwaukee. The West Milwaukee works now consist of a malleable foundry, the construction equipment plant, the conveyor plant, the Research Department, and the principal production offices.

▼

M. E. Nicklin Transfers from Waukesha Motors to Oil Well Supply

M. E. Nicklin

M. E. Nicklin, Export Sales Manager, has resigned his position with the Waukesha Motor Company to return to the oil industry as assistant to W. C. Ramsey, Manager of the Machinery Division of Oil Well Supply Company, with headquarters at Oil City, Pennsylvania.

Mr. Nicklin entered the employ of the Waukesha Motor Company nearly ten years ago as a sales engineer in the Oil Field Division, specializing in the application of multi-cylinder gas and gasoline engines in oil field work. He was soon recognized as an authority in this field, and is the author of a treatise, "Something About Gas Lift," which was published in 1928, and distributed widely throughout the industry.

A native of Pennsylvania, his early field experience prior to becoming Export Manager for the Waukesha Motor Company was gained in and around the Pennsylvania Oil Fields. He is a graduate of Penn State in Mechanical Engineering, is married, and with his wife and son will make his future home at Oil City, Pennsylvania.

▼

Ross Deppe to Represent Tractor & Equipment Co.

Ross Deppe is the latest addition to the personnel of the Tractor & Equipment Co.'s new branch house at Springfield, Ill., according to advices just received from Fred Woltman, Sales Manager. Mr. Deppe will represent the company in the territory where most of his past sales experience has been acquired; in the area between Springfield, Quincy and St. Louis.

▼

Trico Appoints Delavan Engineering Co.

The Delavan Engineering Co., 414 12th St., Des Moines, Iowa, has been appointed Sales Representatives in the States of Iowa and Nebraska for TRICO FUSE MFG. CO.'s complete line of Powder-Packed Renewable Fuses, Kantark One-Time Fuses, Colortop Plug Fuses, Special Fuses, Kliplok Clamps and Test Clamps, Fuse Pullers, and Lubricators.

NEW LITERATURE

National Paving Brick Proceedings.—Proceedings of the 1937 General Sessions of the National Paving Brick Association were issued recently from the Association's headquarters in the National Press Bldg., Washington, D.C., and are available on application. They include a most interesting series of papers on the construction, reconstruction, and maintenance, as well as observations on foreign pavements, and papers on tests, economics and miscellaneous associated subjects.

Portable Crushing and Screening Plant Catalog—Austin-Western Company, Aurora, Illinois, issued a 12-page catalog of its No. 100 Portable Crushing and Screening Plant late in August. The catalog is of standard letter size, thoroughly illustrated with photographs, drawings and diagrams, and contains excellent detailed descriptions as well as condensed specifications of this plant, which has a 9 in. x 40 in. primary jaw crusher, a 30 in. x 18 in. secondary roll crusher, a 3 ft. x 10 ft. 3-deck screen, and other parts to correspond.

Waukesha Engineering Record—This attractive new publication of The Waukesha Motor Company of Waukesha, Wis., is best described in the following editorial from Vol. 1, No. 1.

"At one time, it was our practice to issue an annual publication 'What's New With Waukesha?' Therein we attempted to report Waukesha's progress . . . all new ideas developed and improvements on engines which had been made during the preceding twelve months.

"Such a book is almost an utter impossibility now. Not that it would be impossible to compile a record of these developments and achievements, but it would be beyond reason to expect anyone save ourselves to be really interested in so much that would be 'old news.' Today, changes are coming thick and fast. Our business . . . every business encounters them. We welcome them, and realize that the only way to succeed is to encourage and direct them. That way, as always, leads to progress. And the only time to tell about them is when they are still news. Hence we initiate the 'Waukesha Engineering Record.'

"There's no secret about the purpose of this publication. It's to keep you posted about Waukesha. We think you're interested because we sent you this issue. You will find this different from the ordinary house organ as it has been stripped of all excess baggage, and sticks strictly to its job of giving you the latest news of Waukesha's progress. It's our intention to give you as much information per square inch as is possible without resorting to a dry technical style.

"I, personally, have hoped for something of this sort for a long time. I read this first issue, and enjoyed it, but being a contributor, I'm prejudiced. If any of you others who read it are tempted to comment, please do so—regardless.

"J. E. DeLong."

Curing Modern Concrete Roads with Concrete Special Silicate of Soda—The

foregoing is the title of Bulletin No. 31, issued in August by the Philadelphia Quartz Co., Philadelphia, Pa., and obtainable from them on request. It states briefly the history of concrete curing with silicate, gives observations and the results of tests, characteristics of silicates required for best results, a table of quantities, and specifications for use.

Stresses and Deflections in Loaded Rectangular Plates on Elastic Foundations, an applied-mechanics bulletin by Dr. Glenn Murphy, assistant professor of theoretical and applied mechanics, has been published as Bulletin 135 of the Iowa Engineering Experiment Station at Ames, Iowa.

The bulletin presents a method for determining the stresses and deflections in thin rectangular plates supported on elastic foundations, with particular reference to plates which deflect partially free from the foundation under the action of the load. Results from tests on a square and a rectangular steel plate, each under three conditions of loading, are compared with results given by the theory. Results from an analysis of a concrete pavement slab are essentially in agreement with results from Westergaard's formulas for corner, edge, and center loads. The mathematical analysis is supplemented by tables designed to facilitate calculations of stresses and deflections.

The bulletin may be obtained without charge upon request to—The Director, Iowa Engineering Experiment Station, Iowa State College, Ames, Iowa.

Bituminous Maintenance Equipment—Bulletin M-1, just brought out by Littleford Bros. of Cincinnati contains very clear, illustrative accounts, together with specifications on a wide range of maintenance equipment. Among the more important items are the No. 84-HD Maintenance Kettle in five sizes, the No. 78-OB "Trail-O-Heater," the No. 78-Wood Burning Trail-O-Heater, a barrel hoist, hand spray attachments, one-man patrol heaters, wood burning maintenance kettles, reheaters, combination tool heater and asphaltic cement tank, and many small hand items. The folder is printed on standard 8½ x 11 in. paper.

Chain and Belt Conveying—Chain Belt Company of Milwaukee presents a collection of gorgeous pictures of its equipment in construction and industry in eight pages of "The Rex World," Vol. 3, No. 1. The views include chain and bucket conveyors, Moto-Mixers, Pumpcrete equipment and other items.

Carryall Scraper Bulletin—Just off the press is an 8-page, letter size folder describing seven models of Le Tourneau Carryall Scrapers in sizes from 6 to 17 cubic yards truck measure. Diagrams and clear illustrations help the presentation. At the end is a condensed table of specifications.

Asphalt and Miscellaneous Pump Catalog.—Bulletin No. 15 of the Kinney Manufacturing Co., Boston, Mass., gives clear, illustrated description of a line of pumps for the handling of a wide variety of materials, including asphalt. Ratings, specifications, and other useful tables are included.

Proceedings of Michigan's Twenty-third Annual Highway Conference—The University of Michigan has recently published the proceedings of the highway conference held at Ann Arbor, Feb. 16-18 of this year. Space here permits no more than a listing of titles and authors of the numerous valuable papers.

The San Francisco-Oakland Bay Bridge —C. F. Goodrich
Highway Safety—The New Dynamic —Paul G. Hoffman
Determination of Graduated Speed Regulations—D. Grant Mickle
Improving Traffic Conditions at Street Intersections—Howard F. Ilgner
The Efficiency of Various Types of Railway-Crossing Protection—Warren G. Henry
Industry Takes a Hand in Highway Safety—John J. Holden
The Prone-to-Accident Driver—Lieutenant Elberne H. McConnell
After the Accident—What?—Dr. Frederick A. Coller
State Highway Finances—Russell A. Anderson
Financial Needs of the State Highways —Murray D. Van Wagoner
The Countries' Interests in Highway Finance—Leroy C. Smith
Motor Vehicle Taxation—Pierre Schon
The Physical Chemistry of Highway Subsoils—C. A. Hogentogler
The Design of Flexible Surfaces—William S. Housel
Methods of Soil Stabilization and Low-Cost Roads—F. C. Lang
The History and Development of Michigan Highways—Roger L. Morrison
Transportation Engineering at the University of Michigan

Rubber Springs. A paper on design calculations and representative uses of rubber springs, presented at the annual meeting of the American Society of Mechanical Engineers by Mr. Walter C. Keyes, Mechanical Products Engineer, United States Rubber Products, Inc., and published in the May issue of Mechanical Engineering under the heading, "Rubber Springs" has been reprinted in booklet form for general distribution by the rubber company.

Many charts, tables and line drawings have been incorporated in the booklet, showing the approximate physical properties of various rubber compounds; the load-deflection curves for five typical rubber compounds; load-bearing and bulge areas and area ratio for square slabs 1 in. thick and various lengths of side; shear springs and structural sponge rubber; and a comprehensive chart showing deflection in terms of thickness, per cent. There are also illustrations showing actual installations of various type rubber springs.

The paper is based on years of practical experience in the fields of transportation and diverse manufacturing, and it is anticipated that engineers and others will make practical use of the subject matter which the author has endeavored to make simple and non-technical.

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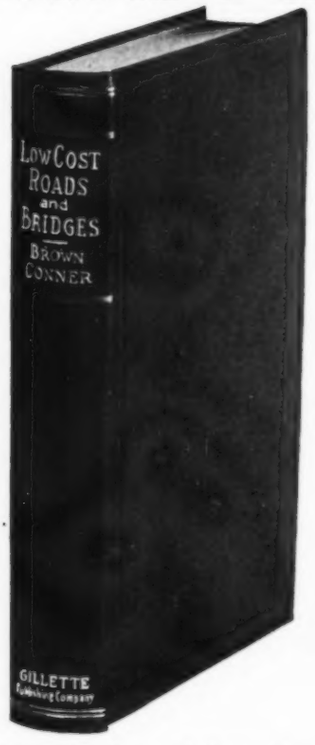

by

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Chairman, Department of Design, Highway Research Board. Formerly Engineering Executive, Am. Road Builders Assoc. Mem. Am. Soc. C. E.

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Congress made this book particularly useful. How? The passage of the Hayden-Cartwright Act authorized $25,000,000 for farm-to-market road work for each fiscal year 1937-38 and 1938-39. The act requires the money to be matched, thereby making $50,00,000 available for each of those two years. This book is a technical treatise on low cost road and bridge design and construction and covers just the type of work expected to be done on the farm-to-market roads.

In ten well-arranged chapters the authors have covered the fundamentals of highway design, economics and planning, grading, surface treatment, low-cost paving materials and their testing, inspection and maintenance. An additional chapter discusses highway bridges. Although the book is not overloaded with illustrations, there are enough to make clear the text.

In a work of this kind, one would not expect to find any discussion of the more expensive types of surfacing —sheet asphalt, brick, stone block, etc.—nor does it appear. The treatment of the lower types, however, is entirely adequate. The authors have not hesitated to enlist the cooperation of a number of specialists, which adds much to the value of their book.

The text is so written that it can be used as a field book for actual construction. Step by step processes are described. Of particular value are the discussions on tar and asphalt and the interpretation of tests of these bituminous materials. The manufacture of bitumens for road work is explained. Other useful information is the section which explains what the various trade named and patented product materials are and their distinguishing characteristics.

Engineering of low cost construction and economics of highway types are thoroughly treated. In compiling the text matter Messrs. Brown and Conner state—"The authors' problem was one of selection, correlation and synthesis, rather than research, experiment and analysis." The book belongs on the desk of every engineer and contractor doing road work.

All the types of low cost surfacing processes are discussed and denfiite "best practice" methods are explained in detail. When considered in conjunction with the discussions on economics, the text indicates definitely what type of improvement is the most economical for a particular road. In fact, herein lies the greatest value of the book—helping the engineer or executive to decide what type of improvement would be the most economical under particular local conditions. The national traffic and highway planning survey will indicate that for economy, many state highways should be improved by some low-cost surface rather than a high type of construction. For this work this book will prove valuable far beyond its cost.

The authors of this volume were far-sighted enough to know that for future construction the economics of highway types would play an increasingly important part in improvement programs. They have, therefore, thoroughly discussed this phase of highway planning.

The book is highly recommended as a criterion of low-cost road construction practices and methods.

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